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Ayloo

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(54) **INTELLIGENT SUBJECT LINE SUGGESTIONS AND REFORMULATION**

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G06F 17/00 (2019.01)
G06F 18/2113 (2023.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06Q 10/107*** (2013.01); ***G06F 18/2113*** (2023.01); ***G06F 40/174*** (2020.01);
(Continued)

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CPC G06F 40/279; G06F 40/274; G06F 40/10; G06F 40/166; G06F 40/174; G06F 40/186; G06F 40/258; G06F 40/20; G06F 18/2113; G06F 40/00; G06F 40/103; G06F 40/169; G06F 40/30; G06F 40/284; G06F 40/211; G06F 18/24; G06K 9/623; G06K 9/6227; G06K 9/6232; G06K 9/6267; G06Q 10/107; G06Q 10/10; G06Q 10/101; G06V 10/768; H04L 51/22; H04L 51/24; H04L 51/26; H04L 51/42; H04L 51/21; H04L 51/216; H04L 51/224; G06N 5/04; G06N 20/00; G06N 5/025
See application file for complete search history.

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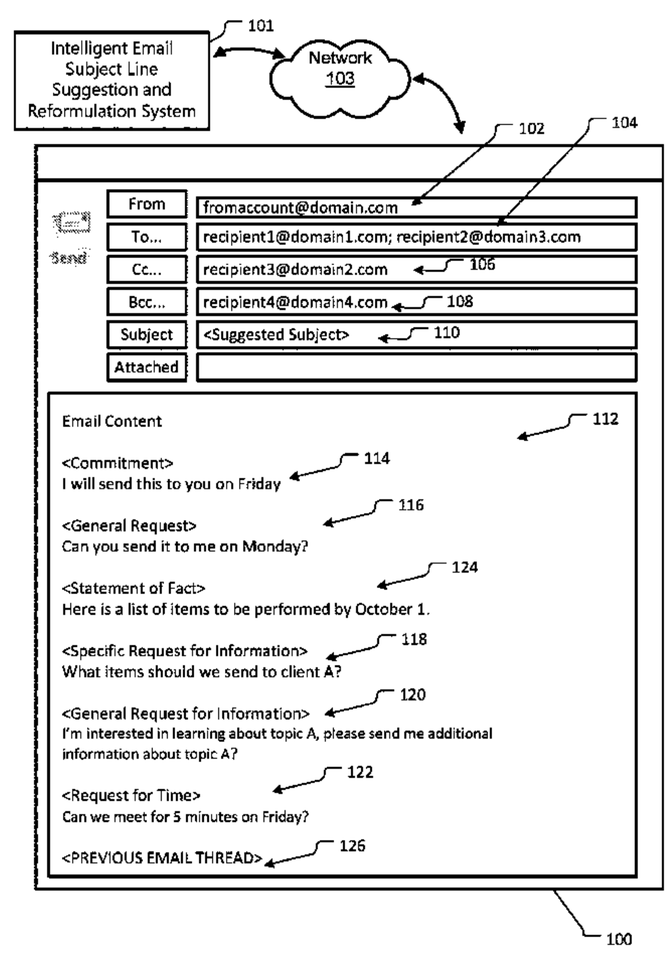
Primary Examiner — Michael Ortiz-Sanchez

(57) **ABSTRACT**

Systems and methods directed to formulating and suggesting a subject line based on content of an email message are provided. More specifically, content corresponding to one or more portions of an email may be received, where the content may be utilized to determine one or more email topics and at least one intent of the email. An intent of the email may correspond to whether an action is to be performed, whether a question is presented, whether a request for time is present, and/or any other request on the part of the recipient or the sender. Based on the intent of the email and the one or more topics, a subject line suggestion may be formulated and presented to a user.

18 Claims, 14 Drawing Sheets



(51) **Int. Cl.**

G06F 40/174	(2020.01)
G06F 40/258	(2020.01)
G06F 40/274	(2020.01)
G06F 40/279	(2020.01)
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H04L 51/42	(2022.01)
G06F 40/166	(2020.01)
G06F 40/186	(2020.01)
G06Q 10/10	(2023.01)

(52) **U.S. Cl.**
CPC ***G06F 40/258*** (2020.01); ***G06F 40/274*** (2020.01); ***G06F 40/279*** (2020.01); ***H04L 51/42*** (2022.05); *G06F 40/166* (2020.01); *G06F 40/186* (2020.01); *G06Q 10/10* (2013.01)

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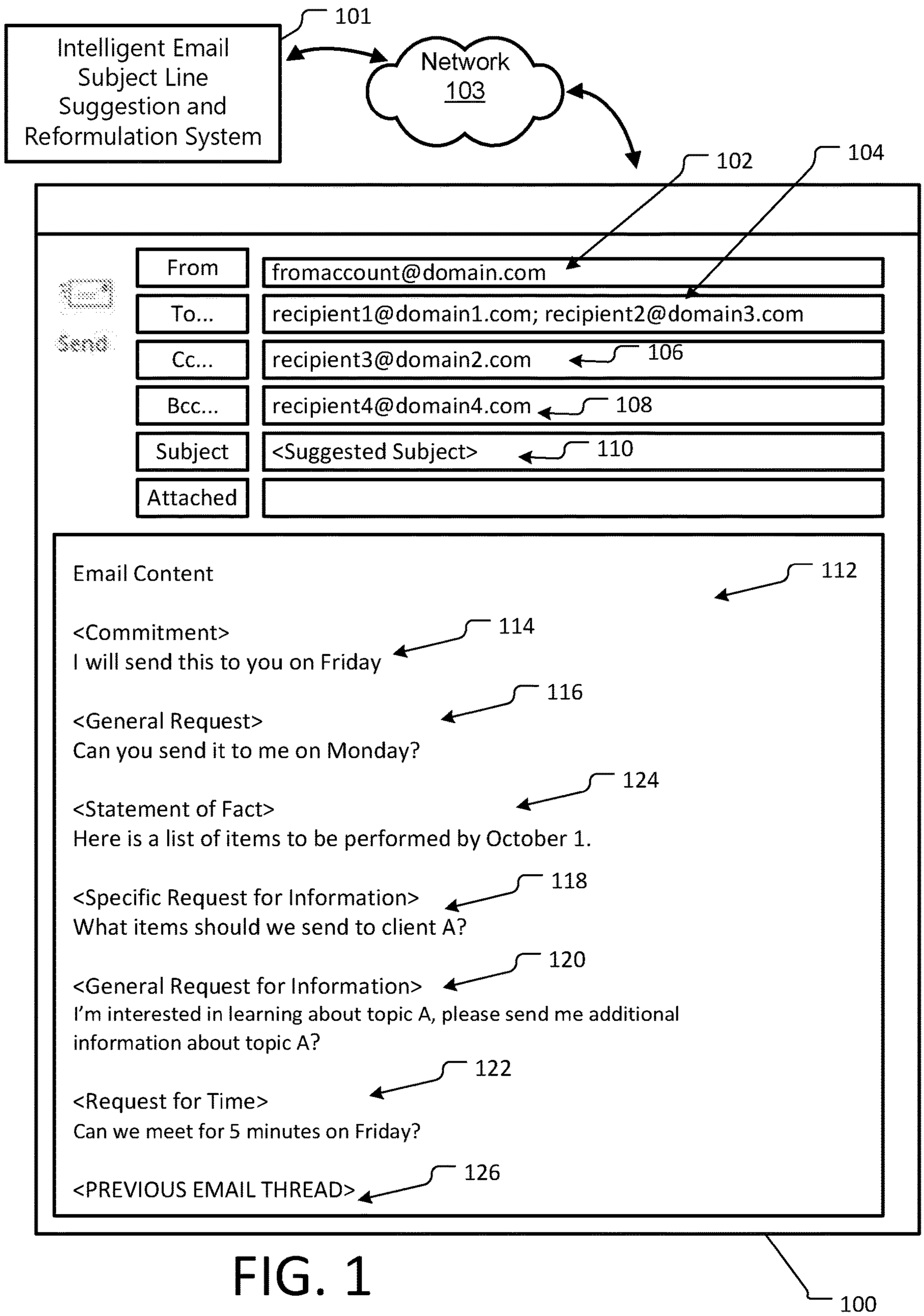
101
Intelligent Email Subject Line Suggestion and Reformulation System
Network 103
102
104
Send
From
fromaccount@domain.com
To...
recipient1@domain1.com; recipient2@domain3.com
Cc...
recipient3@domain2.com
106
Bcc...
recipient4@domain4.com
108
Subject
<Suggested Subject>
110
Attached
Email Content
112
<Commitment>
I will send this to you on Friday
114
<General Request>
Can you send it to me on Monday?
116
<Statement of Fact>
Here is a list of items to be performed by October 1.
124
<Specific Request for Information>
What items should we send to client A?
118
<General Request for Information>
I'm interested in learning about topic A, please send me additional information about topic A?
120
<Request for Time>
Can we meet for 5 minutes on Friday?
122
<PREVIOUS EMAIL THREAD>
126
100

FIG. 1

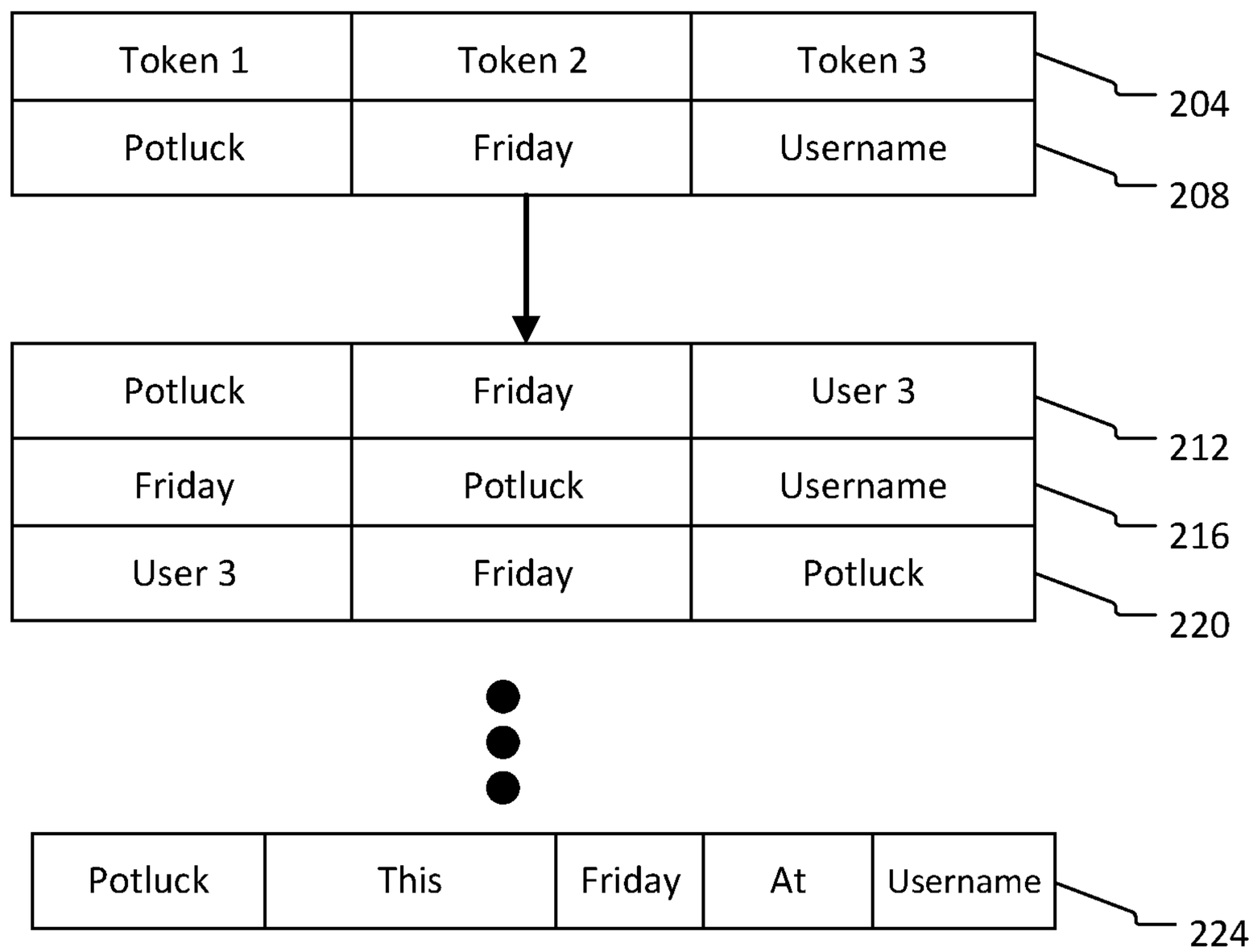
Token 1
Token 2
Token 3
Potluck
Friday
Username
204
208
Potluck
Friday
User 3
Friday
Potluck
Username
User 3
Friday
Potluck
212
216
220
Potluck
This
Friday
At
Username
224

FIG. 2

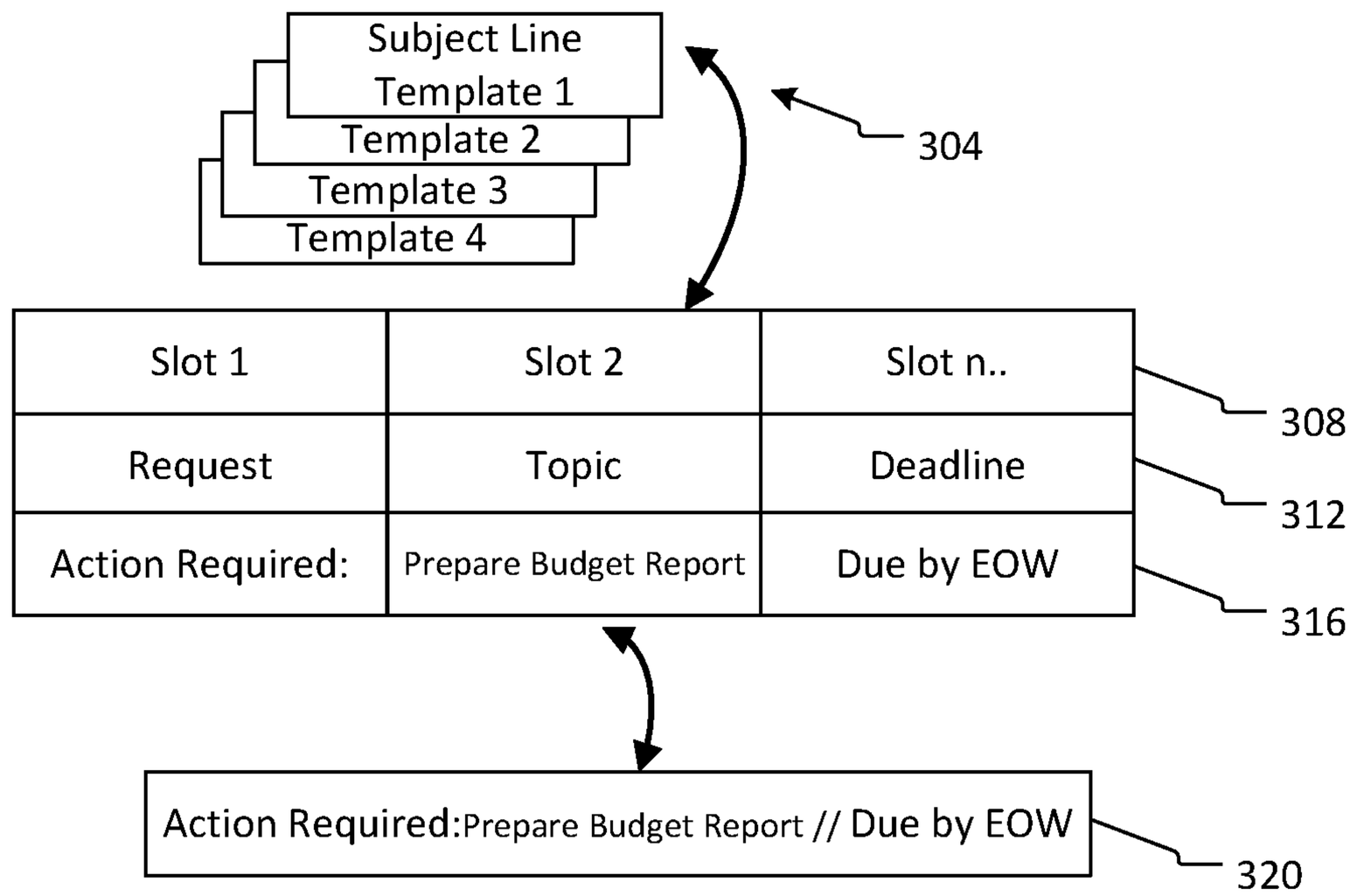
Subject Line
Template 1
Template 2
Template 3
Template 4
304
Slot 1
Slot 2
Slot n..
Request
Topic
Deadline
Action Required:
Prepare Budget Report
Due by EOW
308
312
316
Action Required:Prepare Budget Report // Due by EOW
320

FIG. 3A

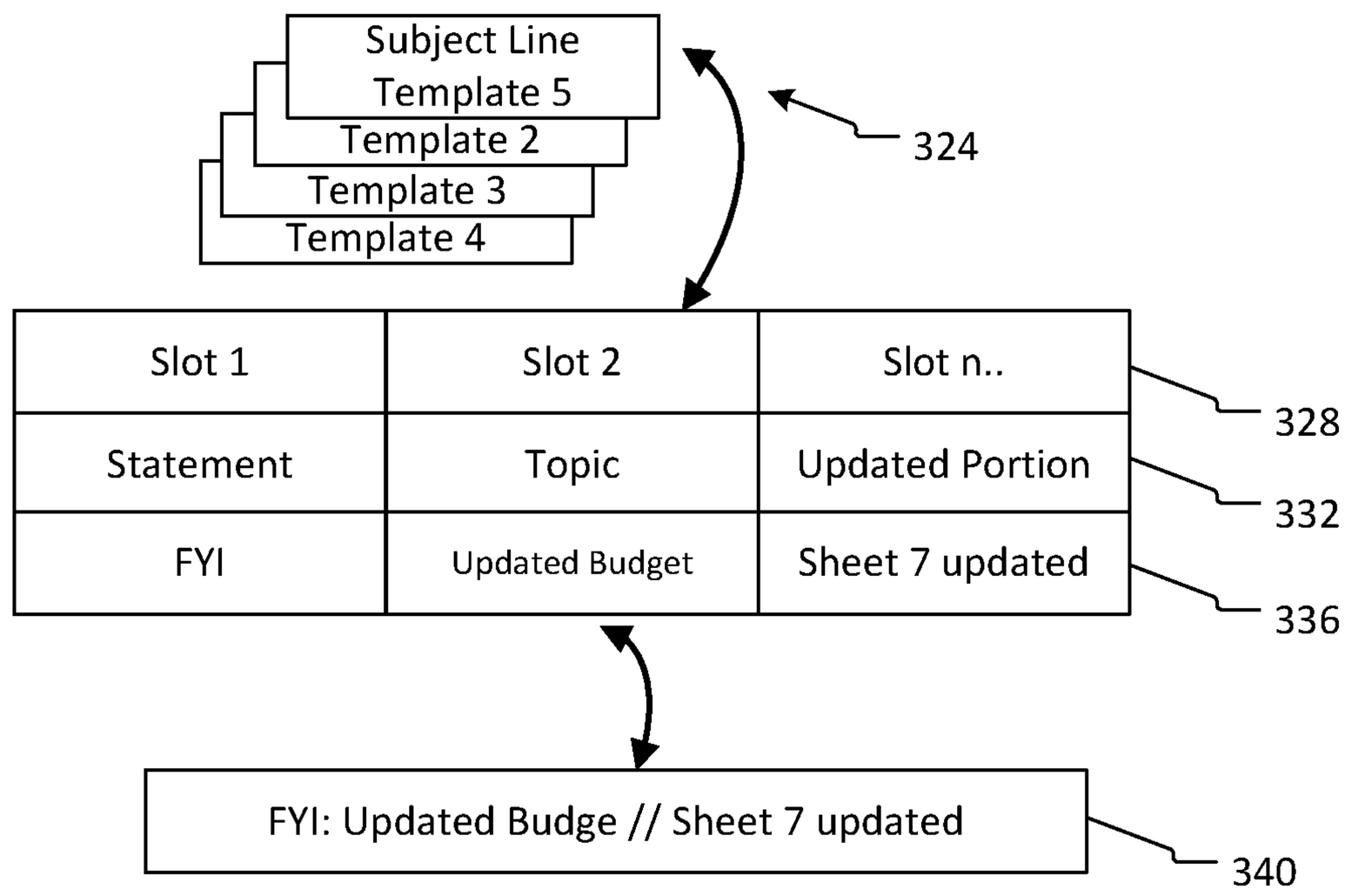
Subject Line
Template 5
Template 2
Template 3
Template 4
324
Slot 1
Slot 2
Slot n..
Statement
Topic
Updated Portion
FYI
Updated Budget
Sheet 7 updated
328
332
336
FYI: Updated Budge // Sheet 7 updated
340

FIG. 3B

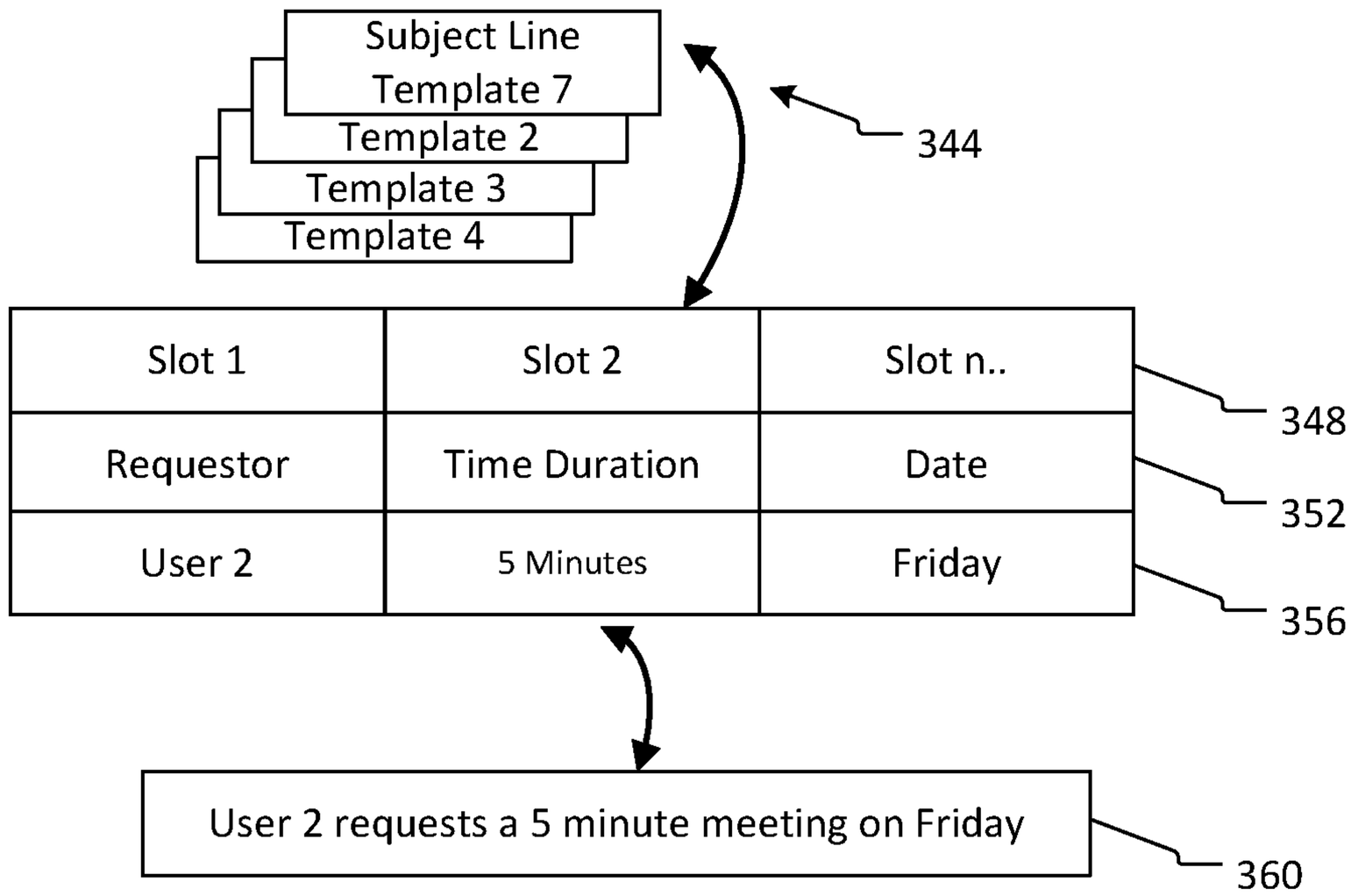
Subject Line
Template 7
Template 2
Template 3
Template 4
344
Slot 1
Slot 2
Slot n..
Requestor
Time Duration
Date
User 2
5 Minutes
Friday
348
352
356
User 2 requests a 5 minute meeting on Friday
360

FIG. 3C

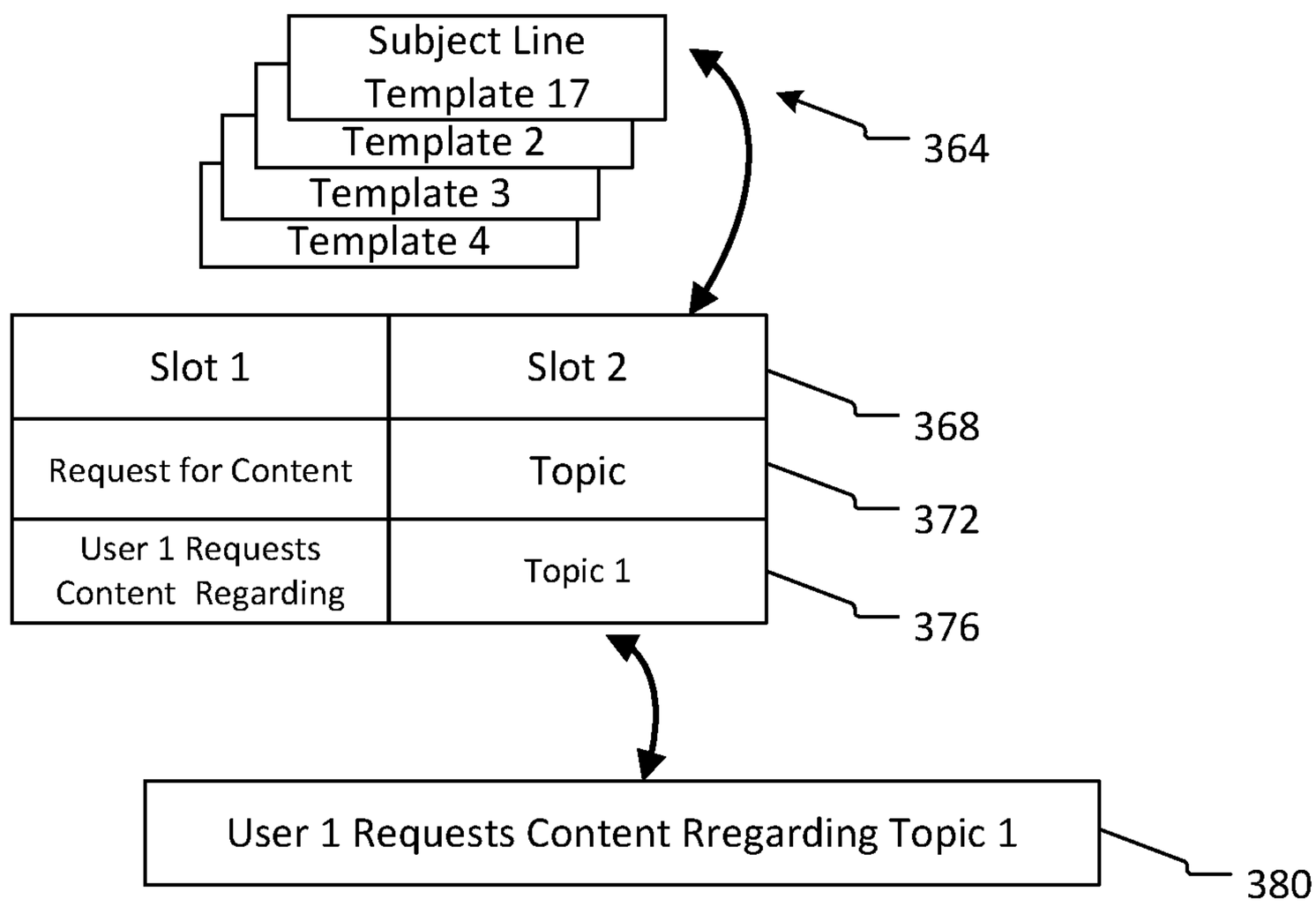
Subject Line
Template 17
Template 2
Template 3
Template 4
364
Slot 1
Slot 2
Request for Content
Topic
User 1 Requests Content Regarding
Topic 1
368
372
376
User 1 Requests Content Rregarding Topic 1
380

FIG. 3D

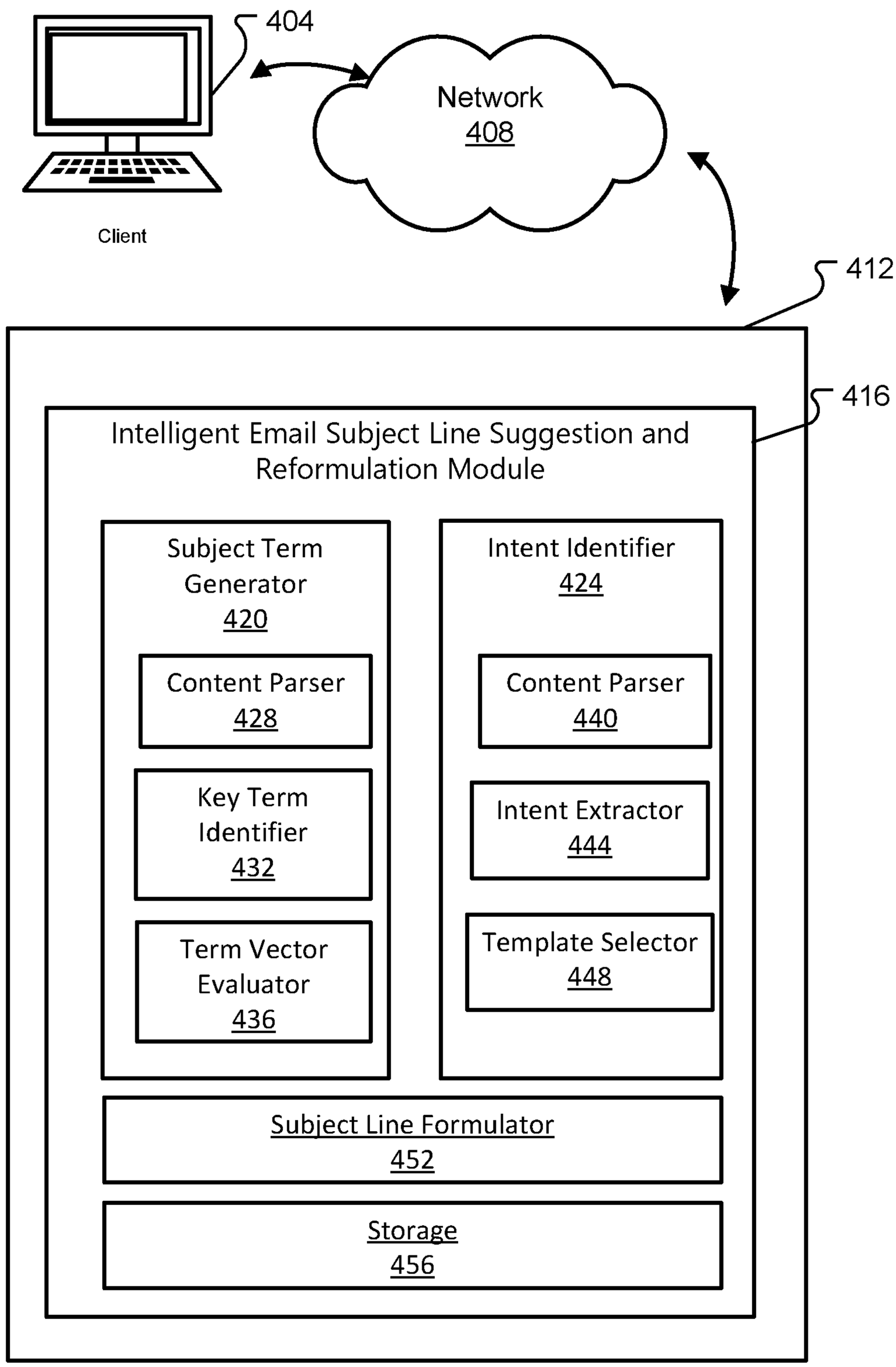
404
Client
Network
408
412
416
Intelligent Email Subject Line Suggestion and Reformulation Module
Subject Term Generator
420
Content Parser
428
Key Term Identifier
432
Term Vector Evaluator
436
Intent Identifier
424
Content Parser
440
Intent Extractor
444
Template Selector
448
Subject Line Formulator
452
Storage
456

FIG. 4

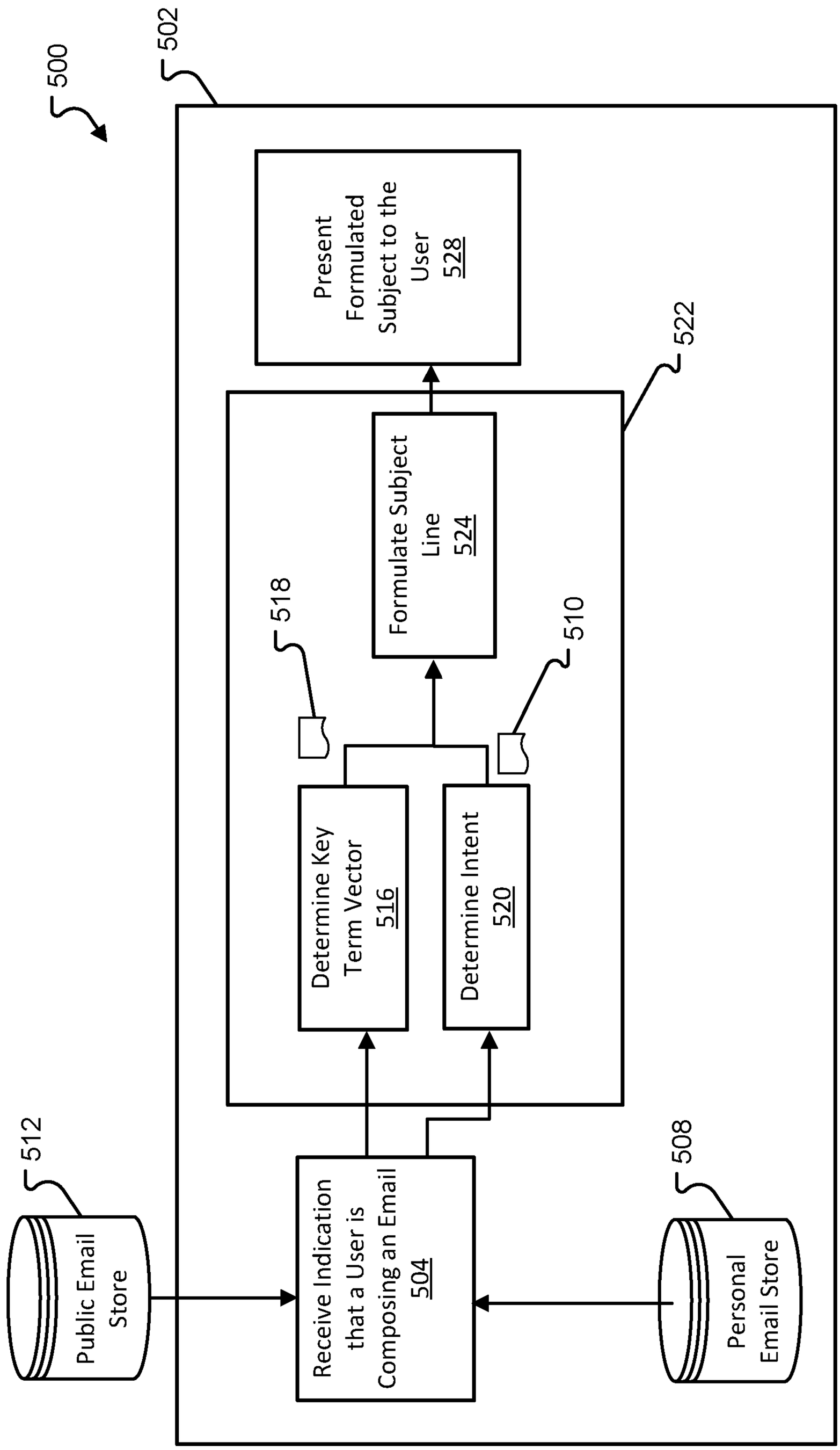
500
502
Present Formulated Subject to the User 528
522
Formulate Subject Line 524
518
510
Determine Key Term Vector 516
Determine Intent 520
512
508
Public Email Store
Receive Indication that a User is Composing an Email 504
Personal Email Store

FIG. 5

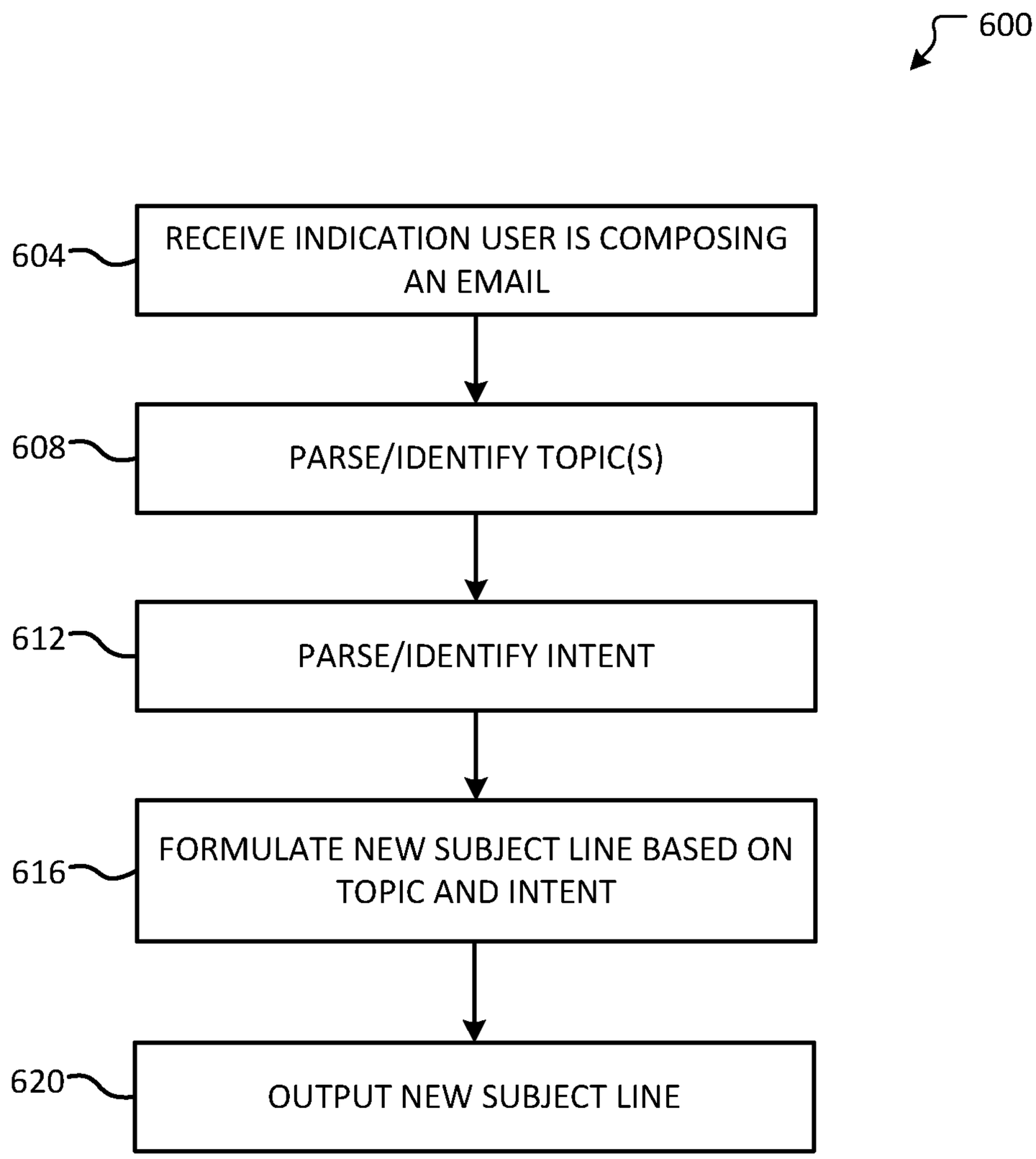
600
604
RECEIVE INDICATION USER IS COMPOSING AN EMAIL
608
PARSE/IDENTIFY TOPIC(S)
612
PARSE/IDENTIFY INTENT
616
FORMULATE NEW SUBJECT LINE BASED ON TOPIC AND INTENT
620
OUTPUT NEW SUBJECT LINE

FIG. 6

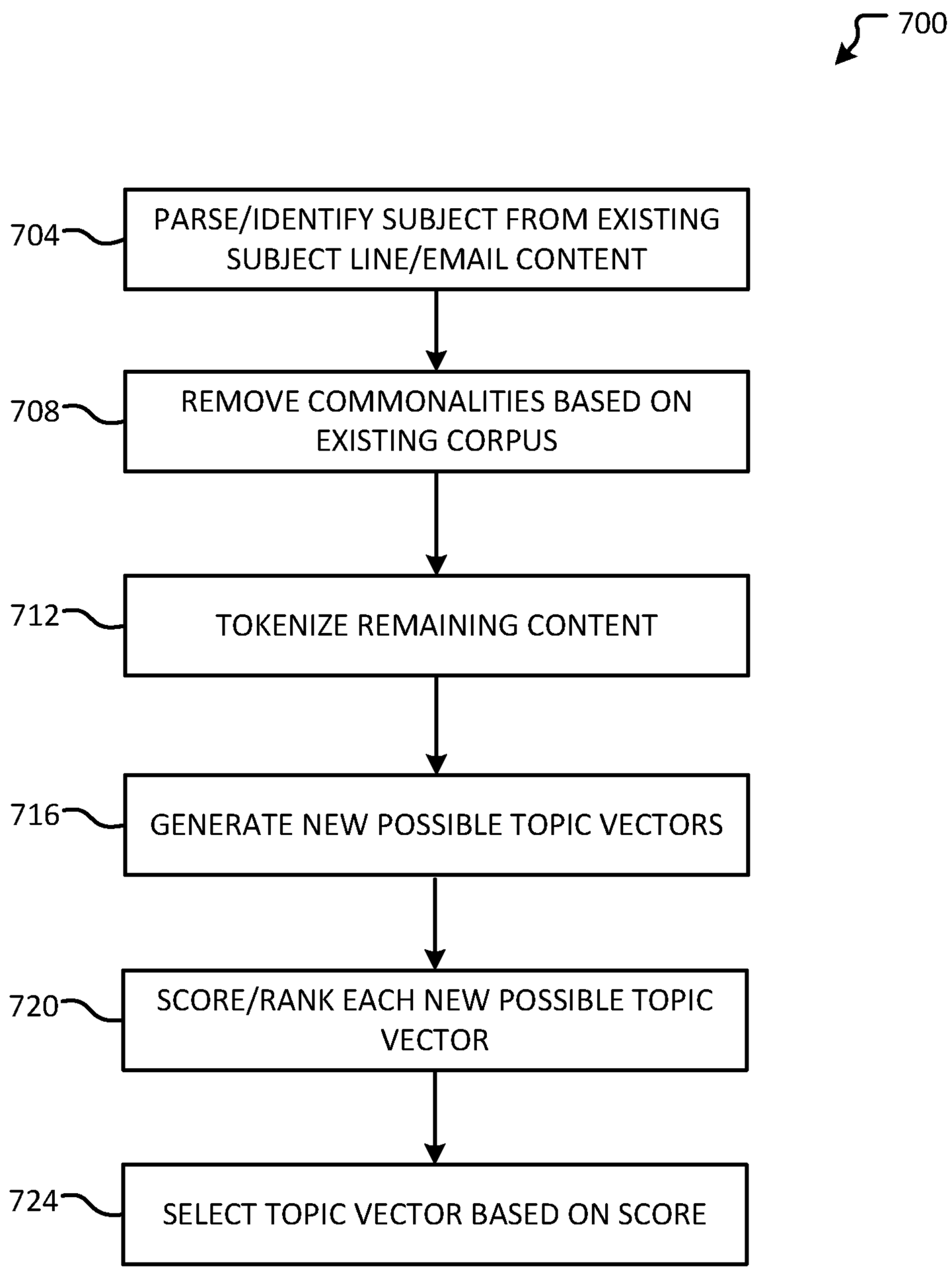
700
704
PARSE/IDENTIFY SUBJECT FROM EXISTING SUBJECT LINE/EMAIL CONTENT
708
REMOVE COMMONALITIES BASED ON EXISTING CORPUS
712
TOKENIZE REMAINING CONTENT
716
GENERATE NEW POSSIBLE TOPIC VECTORS
720
SCORE/RANK EACH NEW POSSIBLE TOPIC VECTOR
724
SELECT TOPIC VECTOR BASED ON SCORE

FIG. 7

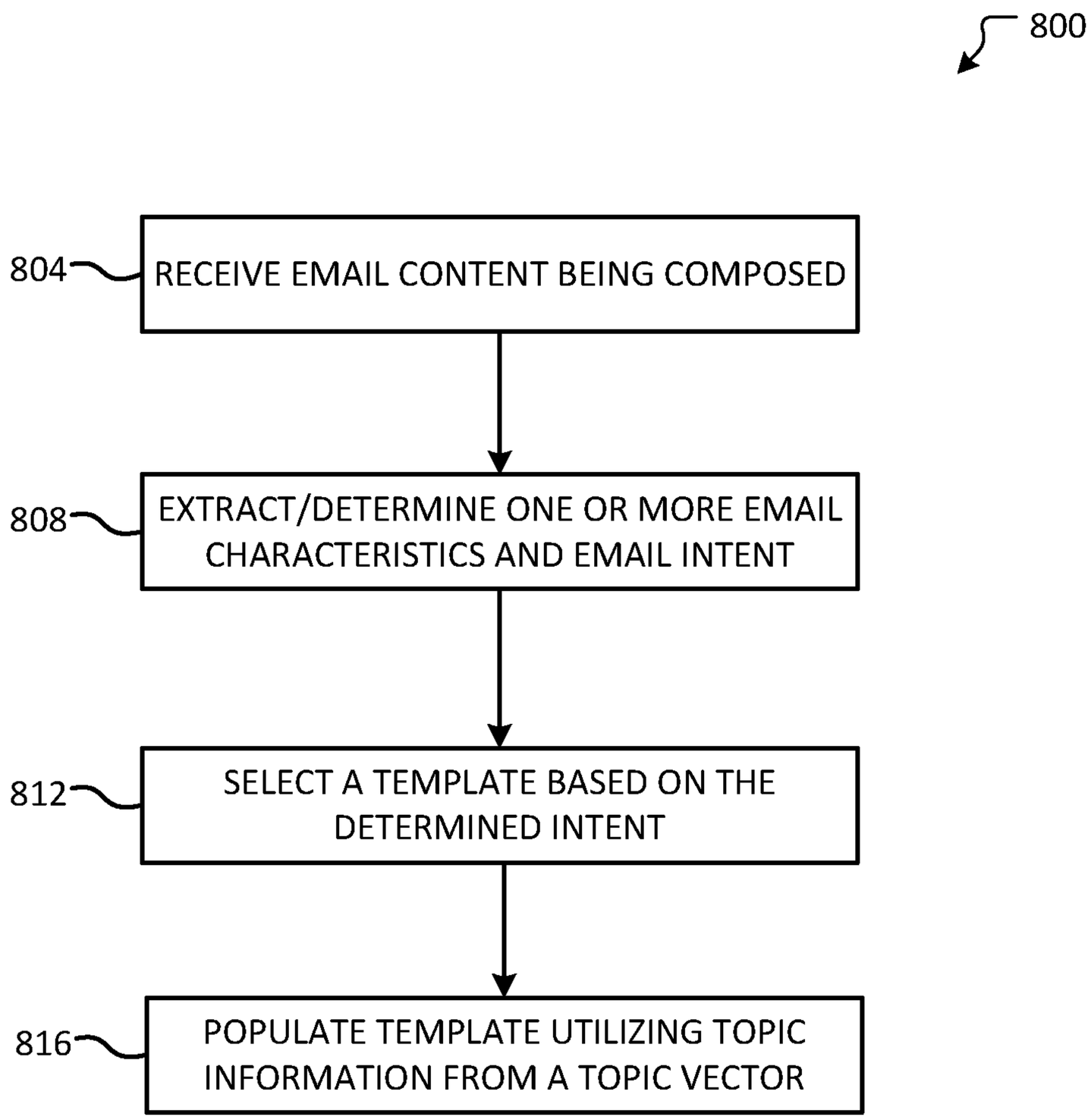
800
804
RECEIVE EMAIL CONTENT BEING COMPOSED
808
EXTRACT/DETERMINE ONE OR MORE EMAIL CHARACTERISTICS AND EMAIL INTENT
812
SELECT A TEMPLATE BASED ON THE DETERMINED INTENT
816
POPULATE TEMPLATE UTILIZING TOPIC INFORMATION FROM A TOPIC VECTOR

FIG. 8

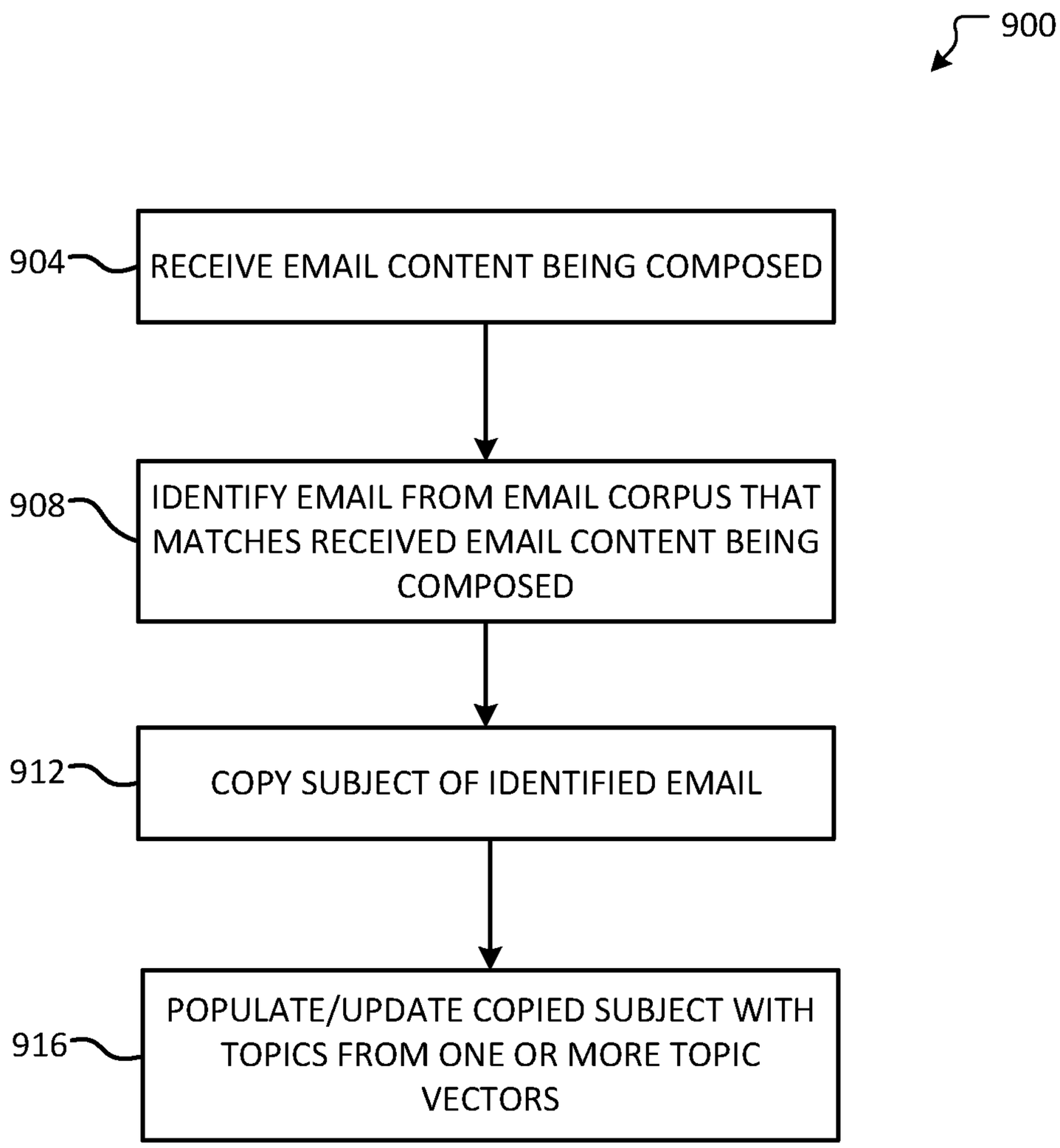
900
904
RECEIVE EMAIL CONTENT BEING COMPOSED
908
IDENTIFY EMAIL FROM EMAIL CORPUS THAT MATCHES RECEIVED EMAIL CONTENT BEING COMPOSED
912
COPY SUBJECT OF IDENTIFIED EMAIL
916
POPULATE/UPDATE COPIED SUBJECT WITH TOPICS FROM ONE OR MORE TOPIC VECTORS

FIG. 9

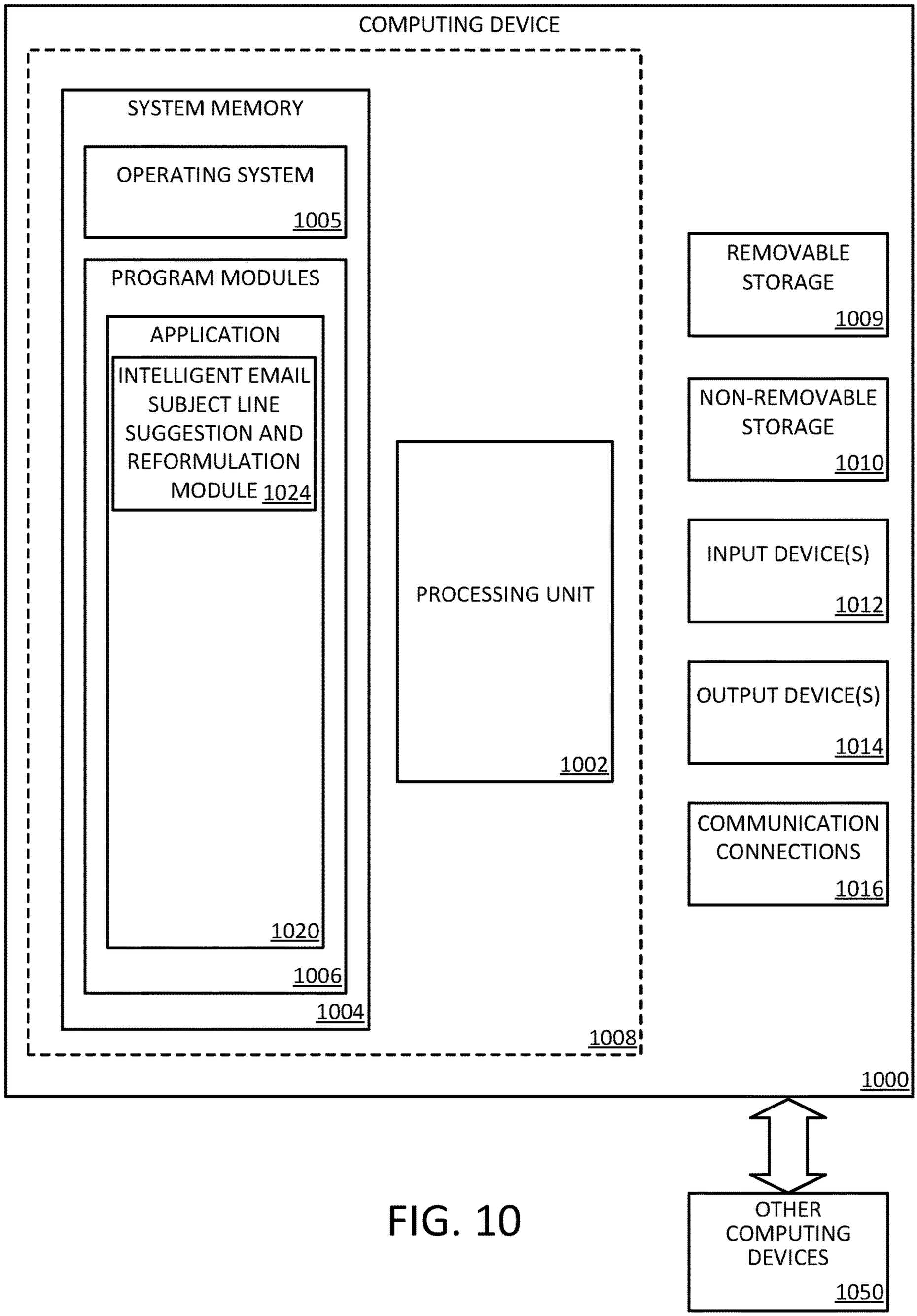
COMPUTING DEVICE
SYSTEM MEMORY
OPERATING SYSTEM
1005
PROGRAM MODULES
APPLICATION
INTELLIGENT EMAIL SUBJECT LINE SUGGESTION AND REFORMULATION MODULE 1024
1020
1006
1004
PROCESSING UNIT
1002
1008
REMOVABLE STORAGE
1009
NON-REMOVABLE STORAGE
1010
INPUT DEVICE(S)
1012
OUTPUT DEVICE(S)
1014
COMMUNICATION CONNECTIONS
1016
1000
OTHER COMPUTING DEVICES
1050

FIG. 10

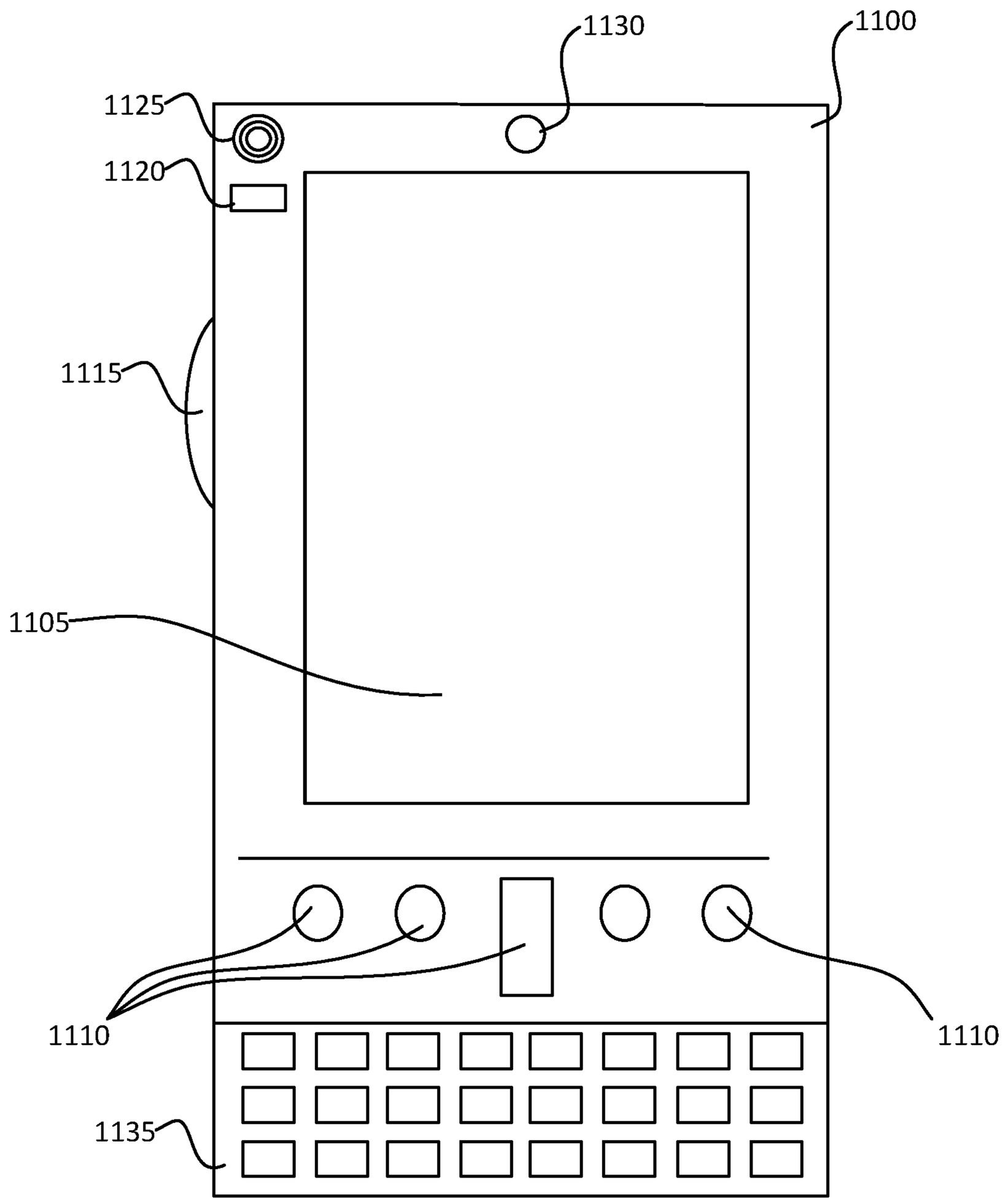

FIG. 11A

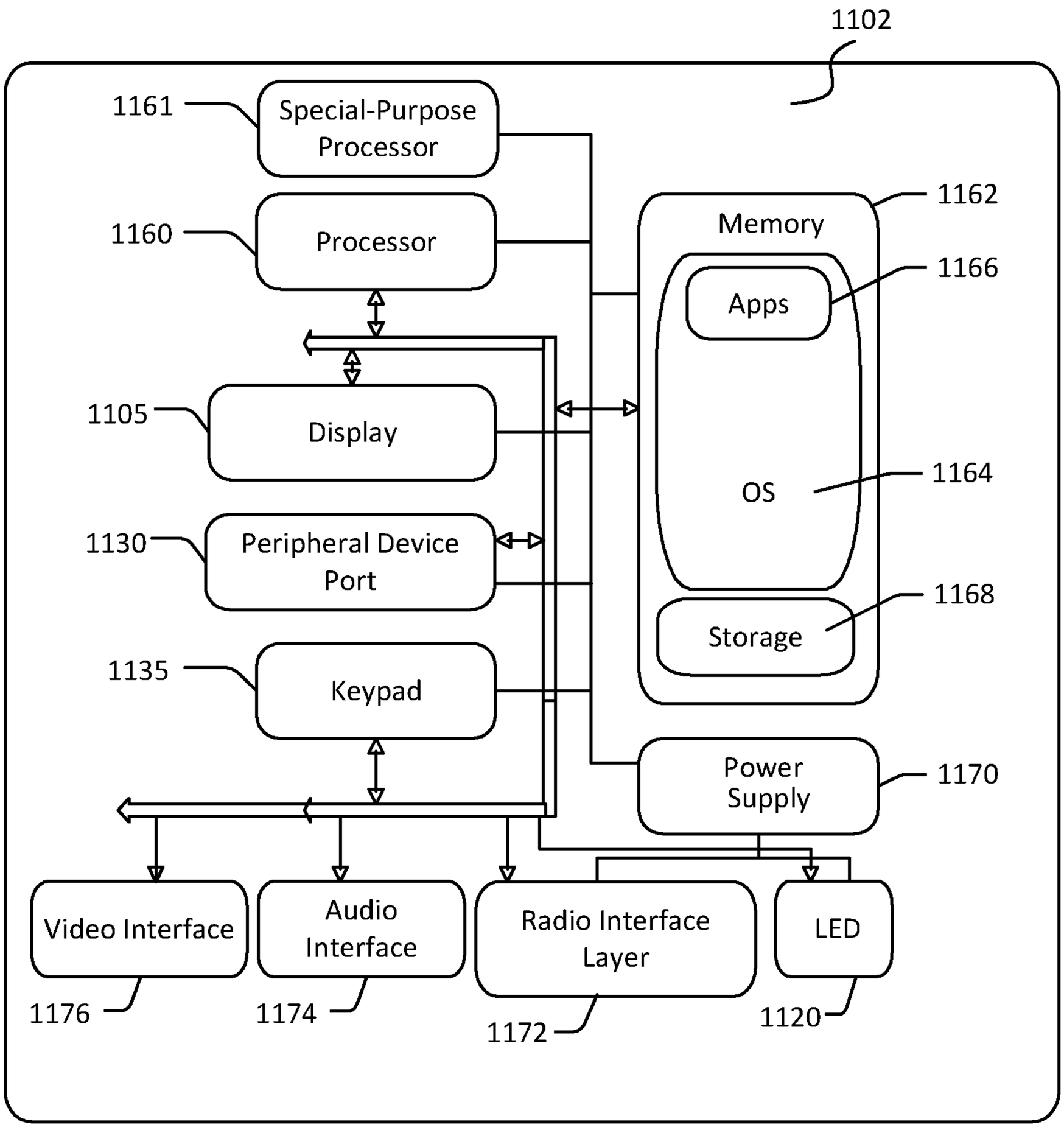
1102
1161
Special-Purpose Processor
1160
Processor
1162
Memory
1166
Apps
1105
Display
1164
OS
1130
Peripheral Device Port
1168
Storage
1135
Keypad
Power Supply
1170
Video Interface
Audio Interface
Radio Interface Layer
LED
1176
1174
1172
1120

FIG. 11B

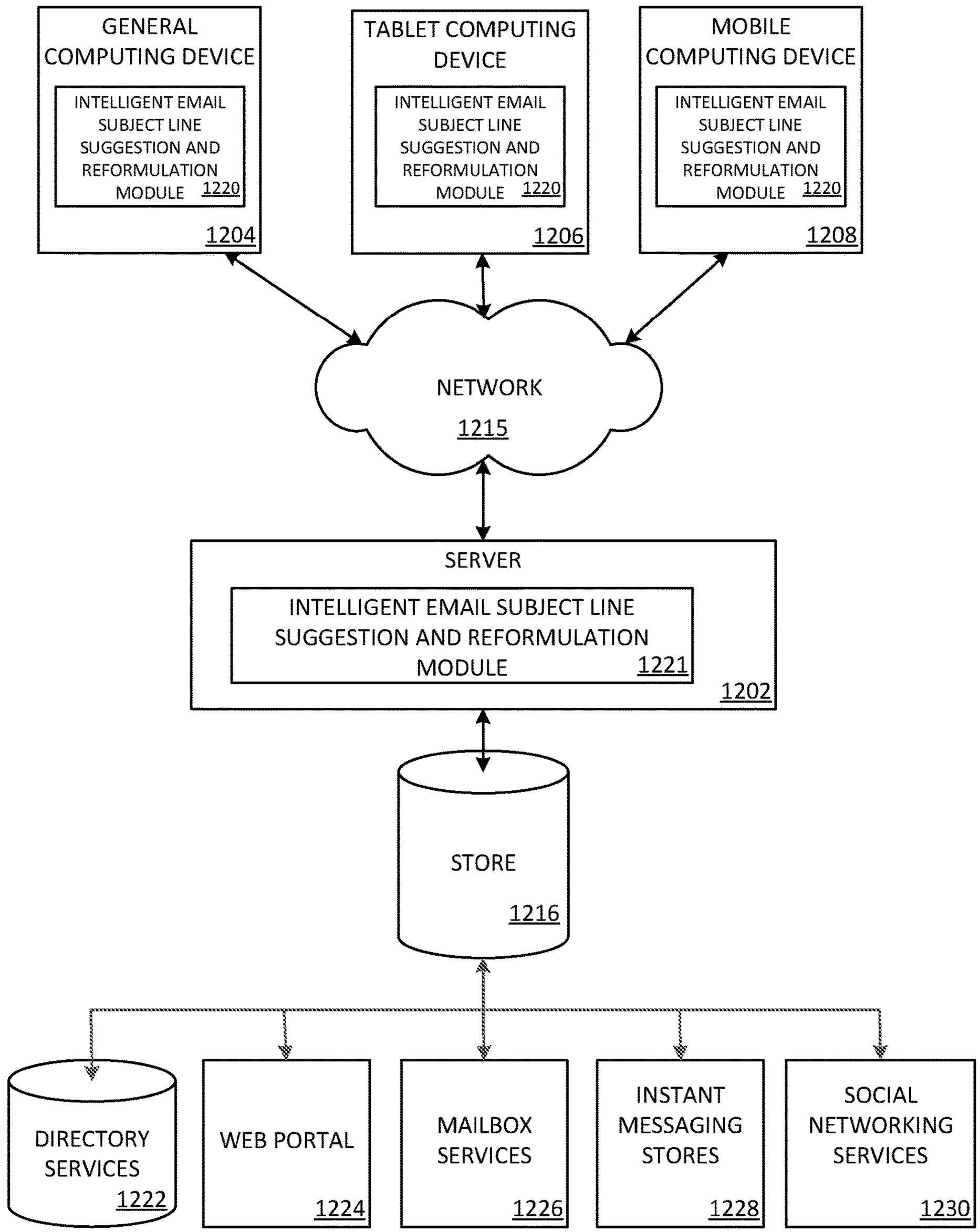
GENERAL COMPUTING DEVICE
INTELLIGENT EMAIL SUBJECT LINE SUGGESTION AND REFORMULATION MODULE 1220
1204
TABLET COMPUTING DEVICE
INTELLIGENT EMAIL SUBJECT LINE SUGGESTION AND REFORMULATION MODULE 1220
1206
MOBILE COMPUTING DEVICE
INTELLIGENT EMAIL SUBJECT LINE SUGGESTION AND REFORMULATION MODULE 1220
1208
NETWORK
1215
SERVER
INTELLIGENT EMAIL SUBJECT LINE SUGGESTION AND REFORMULATION MODULE 1221
1202
STORE
1216
DIRECTORY SERVICES
1222
WEB PORTAL
1224
MAILBOX SERVICES
1226
INSTANT MESSAGING STORES
1228
SOCIAL NETWORKING SERVICES
1230

FIG. 12

INTELLIGENT SUBJECT LINE SUGGESTIONS AND REFORMULATION

BACKGROUND

Existing email applications and providers include features to assist and increase user productivity. An example of such a feature is in the form of a type ahead feature, where as a user begins to compose a word, phrase, or sentence, ghosted text representing a suggested set of letters, words, and/or phrases that complete the initial word, phrase, and/or sentence composition are presented to the user. As another example, a user may compose an email and an email application may provide a subject line suggestion upon initiating a send functionality. However, existing email application often lack advanced features for enhancing sender and recipient productivity.

It is with respect to these and other general considerations that embodiments have been described. Also, although relatively specific problems have been discussed, it should be understood that the embodiments should not be limited to solving the specific problems identified in the background.

SUMMARY

Subject lines in messages, such as email, are attention grabbers and as such they are important to conveying information through email. Accordingly, there is a need to provide intelligence based assistance to one or more users not only composing and/or replying to emails, but also users acting as the recipient. In accordance with some examples, a basic subject line may be suggested based on the content provided in an email composition form; in some examples, the subject line may be suggested based on an existing email thread utilizing one or more machine learning techniques. In some examples, rather than providing a once-size-fits-all email subject line recommendation, subject lines may be tailored and stylized with key elements that for example, highlight if there is "action required" by recipients; highlight if there is a deadline that recipients need to be aware of; highlight or make a user aware that a key attachment or link is being shared, for example, flight tickets, receipts, or links to important articles; and/or highlight key points and/or questions raised in the email. In accordance with some examples, intelligent subject lines may be suggested for each message, even if a message has an existing subject line based on thread history. In some instances, a suggested subject line may be based on the topic and attributes of the current message in addition or instead of the message thread history.

This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting and non-exhaustive examples are described with reference to the following Figures.

FIG. **1** illustrates one or more components of an intelligent email subject line suggestion and reformulation system together with email content in accordance with examples of the present disclosure.

FIG. **2** illustrates one or more topic vectors in accordance with examples of the present disclosure.

FIG. **3**A illustrates a first example of a template utilized to formulate an email subject line suggestion in accordance with examples of the present disclosure.

FIG. **3**B illustrates a second example of a template utilized to formulate an email subject line suggestion in accordance with examples of the present disclosure.

FIG. **3**C illustrates a third example of a template utilized to formulate an email subject line suggestion in accordance with examples of the present disclosure.

FIG. **3**D illustrates a fourth example of a template utilized to formulate an email subject line suggestion in accordance with examples of the present disclosure.

FIG. **4** illustrates details of an intelligent email subject line suggestion and reformulation module in accordance with examples of the present disclosure.

FIG. **5** illustrates details of a system for formulating and suggesting one or more subject lines in accordance with examples of the present disclosure.

FIG. **6** illustrates a first method in accordance with examples of the present disclosure.

FIG. **7** illustrates a second method in accordance with examples of the present disclosure.

FIG. **8** illustrates a third method in accordance with examples of the present disclosure.

FIG. **9** illustrates a fourth method in accordance with examples of the present disclosure.

FIG. **10** is a block diagram illustrating example physical components of a computing device with which aspects of the disclosure may be practiced;

FIG. **11**A is a simplified block diagram of a computing device with which aspects of the present disclosure may be practiced;

FIG. **11**B is another are simplified block diagram of a mobile computing device with which aspects of the present disclosure may be practiced; and

FIG. **12** is a simplified block diagram of a distributed computing system in which aspects of the present disclosure may be practiced.

DETAILED DESCRIPTION

In the following detailed description, references are made to the accompanying drawings that form a part hereof, and in which are shown by way of illustrations specific embodiments or examples. These aspects may be combined, other aspects may be utilized, and structural changes may be made without departing from the present disclosure. Embodiments may be practiced as methods, systems or devices. Accordingly, embodiments may take the form of a hardware implementation, an entirely software implementation, or an implementation combining software and hardware aspects. The following detailed description is therefore not to be taken in a limiting sense, and the scope of the present disclosure is defined by the appended claims and their equivalents.

FIG. **1** illustrates an example email composition window **100** in accordance with examples of the present disclosure. The email composition window **100** may generally be utilized by a user to compose an email, where a user may provide an address from which an email is sent in the sender field **102**, one or more recipient addresses in a recipient field **104**, one or more recipient addresses in the carbon copy field **106**, one or more recipient addresses in the blind carbon copy field **108**, and a subject in the subject line **110**. The email composition window **100** may further include email content **112**, where the email content **112** may include a portion of email content. The subject provided by the user in

the subject line **110** may include a summary description of the portion of email content **112**.

In accordance with examples of the present disclosure, an intelligent email subject line suggestion and reformulation system **101** may generate a subject in place of or otherwise to be included as part of a subject provided by a user in the subject line **110**. More specifically, the intelligent email subject line suggestion and reformulation system **101** may provide a subject that is based on one or more portions of email content **112**. In some examples, the one or more portions of email content **112** may correspond to one or more characteristics identified in the email, such as but not limited to a commitment **114** by a user, a general request **116**, a statement of fact **124**, a specific request for information **118**, a general request for information **120**, and/or a request for time **122**. Of course, other characteristics may be determined by the intelligent email subject line suggestion and reformulation system **101** and may be utilized to formulate a subject for the subject line **110**.

In accordance with examples of the present disclosure, the intelligent email subject line suggestion and reformulation system **101** may identify key topics of an email and/or email thread. For example, if an email is composed regarding a first topic, a machine learning technique may determine unique terms, or unique vocabulary, specific to this email. That is, common phrases, such as pleasantries and greetings like "Hi, how are you doing?", etc., may be identified and removed from the content of the email for purposes of determining one or more possible subjects. In some examples, the composed email may be compared against a universe of emails, the universe of emails being specific to the user composing the email, specific to a group of users, and/or relying on email composition information for a general population of users. Accordingly, commonly used phrases specific to the user, specific to the group, and/or specific to the general population of users may be removed; such commonly used phrases may be removed from the email content **112** to generate unique vocabulary specific to the email being composed. Accordingly, the unique terms, tokens, and/or vocabulary elements may be determined. Given the unique terms, tokens, and/or vocabulary elements for the email, a most likely subject is determined.

FIG. **2** depicts an example of subject line formulation in accordance with examples of the present disclosure. More specifically, a machine learning model may be employed to compose a subject based on the remaining unique terms **204** determined in the email. As one example, the unique terms **208** for a specific non-limiting example may include "Potluck," "Friday," and "User **3**". A first vector **212** may include a first combination of the unique terms, a second vector **216** may include a second combination of unique terms, a third vector **220** may include a third combination of key terms, etc. Each vector may then be scored against possible email subjects determine from the user's inbox and/or other users' inbox across an organization or corpus of user information. Accordingly, a vector **224** for example, having the highest score may be indicated as the most likely subject line. As depicted in FIG. **2**, based on the other possible email subjects, additional linking terms, such as "this" and "at" may be added to a vector; such linking terms may be generated by the intelligent email subject line suggestion and reformulation system **101** and may be based on one or more natural language processing techniques, such as but not limited to tagging parts of speech, shallow parsing and/or chunking, constituency parsing, and dependency parsing. Of course, other natural language processing techniques may be employed to generate a subject based on the identified one or more tokens.

In accordance with some examples of the present disclosure, the intelligent email subject line suggestion and reformulation system **101** may generate a subject based on one or more intents identified within the email content **112**. For example, in addition to forming a subject line, or a portion of a subject line based on a most likely combination of unique terms, the subject line may also include information specific to one or more actions, such as but not limited to a request, question, and/or request for time commitment included in the email content **112**. That is, email content **112** may include a commitment **114**, for example, "I will send this to you on Friday." As another example, the email content **112** may include one or more general requests **116**, for example, "Can you send it to me on Monday?" As another example, the email content **112** may include one or more specific requests for information **118**, such as "What items should we send to client A?" As another example, the email content **112** may include a general request for information **120**, such as "I'm interested in learning about topic A, please send me additional information about topic A." As another example, the email content **112** may include a request for time, such as "Can we meet for 5 minutes on Friday?" Of course, email content **112** may include content that is classified as a statement **122**, such as "Here is a list of items to be performed by October 1."

At least one non-limiting example for determining an intent may include vectorizing one or more portions of the email content and analyzing such portions with an intent classifier. The intent classifier may compare a vectorized portion of content with one or more known intents and/or actions. The classifier may rely upon any of a number of known approaches including but not limited to generalized linear models, support vector machines, nearest neighbors, decision trees and neural networks. In some examples, an intent classifier vectorizes a portion of the email content and may perform a nearest neighbor algorithm comparison between the vectorized portion of email content and the one or more known intents. In some examples, a nearest neighbor vector identifies the intent.

Some intents may be are responsive to objects in the portion of email content. Accordingly, an object classifier may be utilized to identify an object. The object classifier may work in the same or similar manner as the intent classifier. The classifier may rely upon any of a number of machine learning approaches including but not limited to any known generalized linear models, support vector machines, nearest neighbors, decision trees and neural networks. The object classifier may vectorize one or more object attributes which may include but is not limited to parsing the one or more portions of email content into parts of speech, extracting nouns or verbs, and matching to stored object data. In at least one non-limiting example, the object classifier may determine the nearest match, by running a nearest neighbor algorithm comparison; the nearest neighbor may identify one or more objects that will be used as an object in the intent.

Accordingly, based on one or more of the identified intents, such as an identified action and/or statement in the email content **112**, one or more templates for use may be determined and a subject line **110** may be suggested and may include elements or objects from the one or more identified actions and/or statements in the email content **112**.

For example, a template may be defined and/or customized to a user, organization, or otherwise, and may include one or more slots that are to be filled based on the template

and the information pertaining to an identified intent. As depicted in FIG. **3**A, one or more templates **304** may be matched to an identified request; for example, a first template **304** which may include the plurality of slots **308** associated with a request, topic, and deadline **312**. In some examples, the intelligent email subject line suggestion and reformulation system **101** may identify information **316** to fill in or otherwise be placed into the one or more slots **308**/**312**. Accordingly, the intelligent email subject line suggestion and reformulation system **101** may generate a subject **320** corresponding to at least on intent identified in the email content **112**.

As another example depicted in FIG. **3**B, one or more templates **324** may be matched to an identified request; for example, a fifth template **324** which may include the plurality of slots **328** associated with a statement, topic, and specific portion **332** specific to the topic. In some examples, the intelligent email subject line suggestion and reformulation system **101** may identify information **336** to fill in or otherwise be placed into the one or more slots **332**/**328**. Accordingly, the intelligent email subject line suggestion and reformulation system **101** may generate a subject **340** corresponding to at least on intent identified in the email content **112**.

As another example depicted in FIG. **3**C, one or more templates **344** may be matched to an identified request; for example, a seventh template **344** which may include the plurality of slots **348** associated with a request for time which includes a requestor, time duration, and date **352**. In some examples, the intelligent email subject line suggestion and reformulation system **101** may identify information **356** to fill in or otherwise be placed into the one or more slots **352**/**348**. Accordingly, the intelligent email subject line suggestion and reformulation system **101** may generate a subject **360** corresponding to at least on intent identified in the email content **112**.

As another example depicted in FIG. **3**D, one or more templates **364** may be matched to an identified request; for example, a seventeenth template **364** which may include the plurality of slots **368** associated with a request for content and topic **372**. In some examples, the intelligent email subject line suggestion and reformulation system **101** may identify information **376** to fill in or otherwise be placed into the one or more slots **372**/**368**. Accordingly, the intelligent email subject line suggestion and reformulation system **101** may generate a subject **380** corresponding to at least on intent identified in the email content **112**.

As depicted in FIG. **4**, the intelligent email subject line suggestion and reformulation system **412**, which may be the same as or similar to the intelligent email subject line suggestion and reformulation system **101**, and may include an intelligent email subject line suggestion and reformulation module **416** which may generate a proposed subject and/or cause to be displayed to a user the proposed subject to a display for a user. The intelligent email subject line suggestion and reformulation system **412** may include a subject term generator **420**, an intent identifier **424**, a subject line formulator **452**, and storage **456**. The subject term generator **420** may be utilized to generate one or more vectors, such as vectors **212**-**220** for example. In some examples, the subject term generator **420** may include a content parser **428**, key term identifier **432**, and the term vector evaluator **436**. The content parser may receive email content, such as email content **112** and parse such content to identify one or more characteristics of the email content **112**. For example, at least one characteristic may be indicative of an existing thread in the email content **112**. As another example, and in instances where email content corresponds to email content of the entire email message, the at least one characteristic may be indicative of an existing subject field and/or a recipient field. The key term identifier **432** may utilize content provided by the content parser **428** and remove content that is determined to be common to previous emails composed by the user and/or previous emails associated with a corpus of email content. The key term identifier **432** may then provide the key terms to the term vector evaluator **436**, where the term vector evaluator may score differing combinations, including ordered combinations and combinations including additional linking words, to identify a highest scored vector. The highest scored vector may then be provided to the subject line formulator **452**.

In some examples, the intent identifier **424** may include a content parser **440**, an intent extractor **444**, and a template selector **448**. The intent identifier **424** may be utilized to determine an intent of the email content, for example, email content **112**. An intent of email content may include but is not limited to an action, a request for information, a request for time, a statement, a commitment, a specific or general request for information, etc. The content parser **440** may receive email content, such as email content **112** and parse such content to identify one or more characteristics of the email content **112** and/or mark one or more portions of the email content indicative of or otherwise seeming to express an intent. For example, at least one characteristic may be indicative of a new sentence, phrase, and/or word which may indicate the beginning of a portion of the email content that includes the intent. As another example, the at least one characteristic may be indicative of a question, statement, exclamation, or the attachment of a document and/or file. As another example, an intent and/or object may be determined in a manner described above utilizing one or more machine learning approaches.

The intent extractor **444** may evaluate one or more portions of email content provided by the content parser **440** and extract an intent from such portions. In some examples, one or more machine learning approaches described above may be utilized. In some examples, one or more natural language processing techniques may be utilized to identify an intent of the one or more portions of email content. Based on the determined intent, a template, such as one or more of the previously described templates including, but not limited to templates **304**, **324**, **344**, and **364**, may be selected. One or more of the templates may be specific to a user, and organization, and/or other grouping of users. The template selector **448** may further populate one or more slots of the template as previously described. In some instances, the subject line formulator **452** may utilize the selected template to formulate a suggested subject line. In some instances, the subject line formulator **452** may utilize one or more terms from the subject term generator together with the selected template to formulate a suggested subject line. In accordance with examples of the present disclosure, the storage **456** may store the formulated subject line, one or more of the term vectors, the email content **112**, one or more extracted intents, and/or one or more of the templates, selected or otherwise.

In some examples, an email composed by a user may have multiple intents, for example multiple factual statements and/or one or more commitments. In such instances, each of the intents may be identified, ranked, and one or more of the multiple intents may be selected based on which intent has been statistically determined to be most appropriate. In some examples, the multiple intents may indicate that a subject line is to be generalized to accommodate the multiple intents. For example, where an email composed by a user

includes three factual statements, such as "first portion of budget FY20," "second portion of budget FY20," and "third portion of budge FY20," the subject line suggestion may be generalized to "info for budget FY20" for example, where the common element or objet of budget and/or FY20 is identified and the first portion, second portion, and third portion belong to a same category or otherwise classified as being the same or similar.

In some examples, a type of intent may take precedence over another type of intent. For example, where an email portion includes a request and a commitment, the subject line suggestion may include the request instead of the commitment. In some examples, an email portion may include three facts and one request; in such an instance, the request may take precedence and may be included in the suggested subject line instead of the three facts. As previously described, the determination and/or selection of which intent and/or object should be included in a suggested subject line may be based on heuristics and/or user preference.

In some examples, the subject line formulator **452** may preserve a conversation identifier associated with the email content. For example, in an instant where a user replies to an existing email or email thread, the subject of the email thread may be modified or replaced by the subject line formulator **452**; however, in order to preserve the email thread, or conversation, where threads, or conversations, may be grouped by a common subject line, the intelligent email subject line suggestion and reformulation system **412** may preserve a conversation identifier, in metadata for example, and the conversation identifier may be included as part of the email message.

FIG. **5** depicts an example system **500** for formulating and suggesting an email subject line in accordance with examples of the present disclosure. More specifically, the system **500** may include an email subject line suggestion and reformulation system **502** which may be the same as or similar to the email subject line suggestion and reformulation system **412** previously described. An indication that a user is composing an email may be received at **504**, where such indication may correspond to email content, or a portion of email content, being received in an email composition window, such as the email composition window **100**. In some examples, the indication received at **504** may correspond to a user selecting a send email option, button, and/or control and/or correspond to a period of inactivity, wherein the period of inactivity may correspond to a period of inactivity in the email composition window **100** for example. Utilizing a personal email store **508** for example, the email content, or portion of email content, may be compared to emails previously composed by the user to determine common portions of email content that can be removed from the email content, or portion of email content. In addition, a key term vector may be generated as previously described and may rely on key terms of the email content, or portion of email content, remaining after common portions have been removed and/or a corpus of email, such as public email store **512**, utilized to score and rank on or more key term vectors. Accordingly, at **516**, the term vector having a highest score for instance, may be generated as **518**.

In some examples, and at **520**, the email content, or portion of email content, may be parsed such that an intent of the email content, or portion of email content may be determined. For example, the email content, or portion of email content, may include a question or action and such question or action may be considered an "intent" of the email and may be extracted at **520** yielding an intent **510**. In some examples, the intent may be utilized to select a template and the key term vector **518** may be utilized to populate at least a portion of the template—that is, one or more slots may be populated utilizing one or more key terms from the key term vector **518**.

Based on the one or more key terms in the key term vector **518** and based on the intent **510**, a subject line may be formulated. At **528**, the subject line **110** for example of the email composition window **100** may be populated utilizing the formulated subject line. In some examples, the formulated subject line may be presented to a user prior to the formulated subject line being provided to or otherwise presented at the subject line **110** of the email composition window **100**. For example, a user may be able to select the formulated subject line or deny the use of the formulated subject line; a selected formulated subject line may be presented in the subject line **110** whereas denying the formulated subject line may cause a subject line, if present, to remain in the subject line **110**. As depicted in FIG. **5**, the portions within the area **522** may be performed by one or more machine learning approaches discussed above; that is, **522** may be a machine learning model trained to suggest one or more subject lines, where such model may be trained for one or more users and/or one or more organizations. In some cases, the model is consistently retrained based on the acceptance and/or denial of a suggested subject line.

FIG. **6** depicts details of a method **600** for suggesting and formulating an intelligent subject line in accordance with examples of the present disclosure. A general order for the steps of the method **600** is shown in FIG. **6**. Generally, the method **600** starts at **604** and ends at **620**. The method **600** may include more or fewer steps or may arrange the order of the steps differently than those shown in FIG. **6**. The method **600** can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Further, the method **600** can be performed by gates or circuits associated with a processor, Application Specific Integrated Circuit (ASIC), a field programmable gate array (FPGA), a system on chip (SOC), or other hardware device. Hereinafter, the method **600** shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with FIGS. **1-5**.

The method **600** starts at **604**, where an indication that a user is composing an email is received. For example, an indication that a user selected a send email option, command, button or otherwise may be received and/or an indication may be received corresponding to a period of inactivity. Based on the received indication, the method may proceed to **608** where email content, or a portion of email content, may be parsed to identify one or more topics of the email content and/or portion of email content. Based on the one or more topics, a topic vector may be determined as previously described. The method **600** may proceed to **612** where an intent of the email may be identified. For example, the intent may correspond to an action, a request for content, request for specific content, a question, and/or a request for time. While **608** is depicted as occurring before **612**, it should be understood that **608** may be performed after **612** or in parallel with **612**. The method **600** may then flow to **616** where a new subject line may be formulated based on the previously identified topic vector and the identified, or determined, intent. For example, and as previously described, a template may be selected based on intent; such template may be populated utilizing one or more of the topic vectors of **608** for example. At **616**, one or more slots of the

template may be filled with one or more words or combination of words present in the topic vector. The method **600** may then proceed to **620**, where the newly formulated subject line may be presented to the user. I should be understood that as a user adds additional content to the email content and/or portions of email content, the method **600** may be executed multiple times. Accordingly, at a first time, a first newly formulated subject may be presented to a user. At a second time, a second newly formulated subject may be presented to the user. Accordingly, the method **600** may execute in real-time and/or in near real-time.

FIG. **7** depicts details of a method **700** for identifying and/or determining possible topic vectors in accordance with examples of the present disclosure. A general order for the steps of the method **700** is shown in FIG. **7**. Generally, the method **700** starts at **704** and ends at **724**. The method **700** may include more or fewer steps or may arrange the order of the steps differently than those shown in FIG. **7**. The method **700** can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Further, the method **700** can be performed by gates or circuits associated with a processor, Application Specific Integrated Circuit (ASIC), a field programmable gate array (FPGA), a system on chip (SOC), or other hardware device. Hereinafter, the method **700** shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with FIGS. **1-6**.

The method **700** starts at **704**, where email content may be received. A portion of email content may correspond to the email content **112** and/or content of the subject line **110**. At **708**, commonalities between the email content received at **704** and email content corresponding to an existing corpus of email may be determined and such commonalities may be removed, leaving unique vocabulary and/or topic content. The existing corpus of email may correspond to a personal email store where user composed emails may be utilized as a source of identifying common expressions and common vocabulary used in prior email compositions. Alternatively, or in addition, the existing corpus of email may correspond to a public email store where emails composed from multiple users may be utilized as a source of identifying common expressions and common vocabulary. At **708**, the common vocabulary and/or common expressions may be removed from the email content received at **704**.

At **712**, the remaining content may be tokenized and a plurality of topic vectors may be determined at **716** as previously described. At **720**, each new possible topic vector may be scored utilizing an existing corpus of email content. In some examples, the existing corpus of email content may be the same as or similar to the existing corpus of email content utilized at **708**. In some examples, the existing corpus of email content may be different from the existing corpus of email content utilized at **708**. Based on the score of each topic vector, a topic vector representing a most likely ordering of topics may be selected. For example, the topic vector having a highest score may be selected. The selected topic vector may then be utilized to generate a new subject line, such as in **616** as previously described.

FIG. **8** depicts details of a method **800** for determining an intent from email content in accordance with examples of the present disclosure. A general order for the steps of the method **800** is shown in FIG. **8**. Generally, the method **800** starts at **804** and ends at **816**. The method **800** may include more or fewer steps or may arrange the order of the steps differently than those shown in FIG. **8**. The method **800** can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Further, the method **800** can be performed by gates or circuits associated with a processor, Application Specific Integrated Circuit (ASIC), a field programmable gate array (FPGA), a system on chip (SOC), or other hardware device. Hereinafter, the method **800** shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with FIGS. **1-7**.

The method **800** starts at **804**, where email content may be received. The email content may correspond to a portion of email content **112**, content of the subject line **110**, and/or content of one or more fields described with respect to FIG. **1**. At **808**, one or more characteristics of the email may be extracted and/or determined. For example, a portion of the email content **112** may indicate that an action is required on the part of the email sender (user composing the email). Accordingly, a characteristic may indicate that an action is to be performed; accordingly, an intent of the email may be to provide the recipient with an action. As another example, email content **112** may indicate that a question is being presented to an email recipient. Accordingly, a characteristic of the email may indicate that an intent of the email is to present a question.

FIG. **9** depicts details of another method **900** for providing an email subject line suggestion. A general order for the steps of the method **900** is shown in FIG. **9**. Generally, the method **900** starts at **904** and ends at **916**. The method **900** may include more or fewer steps or may arrange the order of the steps differently than those shown in FIG. **9**. The method **900** can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Further, the method **900** can be performed by gates or circuits associated with a processor, Application Specific Integrated Circuit (ASIC), a field programmable gate array (FPGA), a system on chip (SOC), or other hardware device. Hereinafter, the method **900** shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with FIGS. **1-8**.

The method **900** starts at **904**, where email content may be received. The email content may correspond to a portion of the email content **112**, content of the subject line **110**, and/or content of one or more fields described with respect to FIG. **1**. At **908**, an email containing content that closely matches the received email content may be identified and/or determined at **908**. For example, a user may have sent an email to a first recipient; where the email to the first recipient includes the same or similar information to be sent to a second separate recipient. Accordingly, the email sent to the first recipient may be determined/identified. At **912**, the subject of the identified/determined email may be copied. That is, if the information going to the second recipient is substantially similar to the information going to the first recipient, the subject line of the email going to the first recipient may be utilized as a template, or base, for formulating the subject line. Accordingly, at **916**, the copied subject line may be updated/populated utilizing one or more topics identified from a topic vector as previously described.

FIGS. **10-12** and the associated descriptions provide a discussion of a variety of operating environments in which aspects of the disclosure may be practiced. However, the devices and systems illustrated and discussed with respect to FIGS. **10-12** are for purposes of example and illustration and are not limiting of a vast number of computing device configurations that may be utilized for practicing aspects of the disclosure, described herein.

FIG. **10** is a block diagram illustrating physical components (e.g., hardware) of a computing device **1000** with which aspects of the disclosure may be practiced. The computing device components described below may be suitable for the computing devices described above. In a basic configuration, the computing device **1000** may include at least one processing unit **1002** and a system memory **1004**. Depending on the configuration and type of computing device, the system memory **1004** may comprise, but is not limited to, volatile storage (e.g., random access memory), non-volatile storage (e.g., read-only memory), flash memory, or any combination of such memories.

The system memory **1004** may include an operating system **1005** and one or more program modules **1006** suitable for running software application **1020**, such as one or more components supported by the systems described herein. As examples, system memory **1004** may store the intelligent email subject line suggestion and reformulation module **1024**. The operating system **1005**, for example, may be suitable for controlling the operation of the computing device **1000**.

Furthermore, embodiments of the disclosure may be practiced in conjunction with a graphics library, other operating systems, or any other application program and is not limited to any particular application or system. This basic configuration is illustrated in FIG. **10** by those components within a dashed line **1008**. The computing device **1000** may have additional features or functionality. For example, the computing device **1000** may also include additional data storage devices (removable and/or non-removable) such as, for example, magnetic disks, optical disks, or tape. Such additional storage is illustrated in FIG. **10** by a removable storage device **1009** and a non-removable storage device **1010**.

As stated above, a number of program modules and data files may be stored in the system memory **1004**. While executing on the at least one processing unit **1002**, the program modules **1006** (e.g., application **1020**) may perform processes including, but not limited to, the aspects, as described herein. Other program modules that may be used in accordance with aspects of the present disclosure may include electronic mail and contacts applications, word processing applications, spreadsheet applications, database applications, slide presentation applications, drawing or computer-aided application programs, etc.

Furthermore, embodiments of the disclosure may be practiced in an electrical circuit comprising discrete electronic elements, packaged or integrated electronic chips containing logic gates, a circuit utilizing a microprocessor, or on a single chip containing electronic elements or microprocessors. For example, embodiments of the disclosure may be practiced via a system-on-a-chip (SOC) where each or many of the components illustrated in FIG. **10** may be integrated onto a single integrated circuit. Such an SOC device may include one or more processing units, graphics units, communications units, system virtualization units and various application functionality all of which are integrated (or "burned") onto the chip substrate as a single integrated circuit. When operating via an SOC, the functionality, described herein, with respect to the capability of client to switch protocols may be operated via application-specific logic integrated with other components of the computing device **1000** on the single integrated circuit (chip). Embodiments of the disclosure may also be practiced using other technologies capable of performing logical operations such as, for example, AND, OR, and NOT, including but not limited to mechanical, optical, fluidic, and quantum technologies. In addition, embodiments of the disclosure may be practiced within a general purpose computer or in any other circuits or systems.

The computing device **1000** may also have one or more input device(s) **1012** such as a keyboard, a mouse, a pen, a sound or voice input device, a touch or swipe input device, etc. The output device(s) **1014** such as a display, speakers, a printer, etc. may also be included. The aforementioned devices are examples and others may be used. The computing device **1000** may include one or more communication connections **1016** allowing communications with other computing devices **1050**. Examples of suitable communication connections **1016** include, but are not limited to, radio frequency (RF) transmitter, receiver, and/or transceiver circuitry; universal serial bus (USB), parallel, and/or serial ports.

The term computer readable media as used herein may include computer storage media. Computer storage media may include volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information, such as computer readable instructions, data structures, or program modules. The system memory **1004**, the removable storage device **1009**, and the non-removable storage device **1010** are all computer storage media examples (e.g., memory storage). Computer storage media may include RAM, ROM, electrically erasable read-only memory (EEPROM), flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other article of manufacture which can be used to store information and which can be accessed by the computing device **1000**. Any such computer storage media may be part of the computing device **1000**. Computer storage media does not include a carrier wave or other propagated or modulated data signal.

Communication media may be embodied by computer readable instructions, data structures, program modules, or other data in a modulated data signal, such as a carrier wave or other transport mechanism, and includes any information delivery media. The term "modulated data signal" may describe a signal that has one or more characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, radio frequency (RF), infrared, and other wireless media.

FIGS. **11**A and **11**B illustrate a mobile computing device **1100**, for example, a mobile telephone, a smart phone, wearable computer (such as a smart watch), a tablet computer, a laptop computer, and the like, with which embodiments of the disclosure may be practiced. In some aspects, the client may be a mobile computing device. With reference to FIG. **11**A, one aspect of a mobile computing device **1100** for implementing the aspects is illustrated. In a basic configuration, the mobile computing device **1100** is a handheld computer having both input elements and output elements. The mobile computing device **1100** typically includes a display **1105** and one or more input buttons **1110** that allow the user to enter information into the mobile computing device **1100**. The display **1105** of the mobile computing device **1100** may also function as an input device (e.g., a touch screen display).

If included, an optional side input element **1115** allows further user input. The side input element **1115** may be a rotary switch, a button, or any other type of manual input

element. In alternative aspects, mobile computing device **1100** may incorporate more or less input elements. For example, the display **1105** may not be a touch screen in some embodiments.

In yet another alternative embodiment, the mobile computing device **1100** is a portable phone system, such as a cellular phone. The mobile computing device **1100** may also include an optional keypad **1135**. Optional keypad **1135** may be a physical keypad or a "soft" keypad generated on the touch screen display.

In various embodiments, the output elements include the display **1105** for showing a graphical user interface (GUI), a visual indicator **820** (e.g., a light emitting diode), and/or an audio transducer **1125** (e.g., a speaker). In some aspects, the mobile computing device **1100** incorporates a vibration transducer for providing the user with tactile feedback. In yet another aspect, the mobile computing device **1100** incorporates input and/or output ports, such as an audio input (e.g., a microphone jack), an audio output (e.g., a headphone jack), and a video output (e.g., a HDMI port) for sending signals to or receiving signals from an external device.

FIG. **11**B is a block diagram illustrating the architecture of one aspect of a mobile computing device. That is, the mobile computing device **1100** can incorporate a system (e.g., an architecture) **1102** to implement some aspects. In one embodiment, the system **1102** is implemented as a "smart phone" capable of running one or more applications (e.g., browser, e-mail, calendaring, contact managers, messaging clients, games, and media clients/players). In some aspects, the system **1102** is integrated as a computing device, such as an integrated personal digital assistant (PDA) and wireless phone.

One or more application programs **1166** may be loaded into the memory **1162** and run on or in association with the operating system **1164**. Examples of the application programs include phone dialer programs, e-mail programs, personal information management (PIM) programs, word processing programs, spreadsheet programs, Internet browser programs, messaging programs, and so forth. The system **1102** also includes a non-volatile storage area **1168** within the memory **1162**. The non-volatile storage area **1168** may be used to store persistent information that should not be lost if the system **1102** is powered down. The application programs **1166** may use and store information in the non-volatile storage area **1168**, such as e-mail or other messages used by an e-mail application, and the like. A synchronization application (not shown) also resides on the system **1102** and is programmed to interact with a corresponding synchronization application resident on a host computer to keep the information stored in the non-volatile storage area **1168** synchronized with corresponding information stored at the host computer. As should be appreciated, other applications may be loaded into the memory **1162** and run on the mobile computing device **1100** described herein (e.g., search engine, extractor module, relevancy ranking module, answer scoring module, etc.).

The system **1102** has a power supply **1170**, which may be implemented as one or more batteries. The power supply **1170** might further include an external power source, such as an AC adapter or a powered docking cradle that supplements or recharges the batteries.

The system **1102** may also include a radio interface layer **1172** that performs the function of transmitting and receiving radio frequency communications. The radio interface layer **1172** facilitates wireless connectivity between the system **1102** and the "outside world," via a communications carrier or service provider. Transmissions to and from the radio interface layer **1172** are conducted under control of the operating system **1164**. In other words, communications received by the radio interface layer **1172** may be disseminated to the application programs **1166** via the operating system **1164**, and vice versa.

The visual indicator **1120** may be used to provide visual notifications, and/or an audio interface **1174** may be used for producing audible notifications via the audio transducer **1125**. In the illustrated embodiment, the visual indicator **1120** is a light emitting diode (LED) and the audio transducer **1125** is a speaker. These devices may be directly coupled to the power supply **1170** so that when activated, they remain on for a duration dictated by the notification mechanism even though the processor **1160** and other components might shut down for conserving battery power. The LED may be programmed to remain on indefinitely until the user takes action to indicate the powered-on status of the device. The audio interface **1174** is used to provide audible signals to and receive audible signals from the user. For example, in addition to being coupled to the audio transducer **1125**, the audio interface **1174** may also be coupled to a microphone to receive audible input, such as to facilitate a telephone conversation. In accordance with embodiments of the present disclosure, the microphone may also serve as an audio sensor to facilitate control of notifications, as will be described below. The system **1102** may further include a video interface **1176** that enables an operation of an on-board camera **1130** to record still images, video stream, and the like.

A mobile computing device **1100** implementing the system **1102** may have additional features or functionality. For example, the mobile computing device **1100** may also include additional data storage devices (removable and/or non-removable) such as, magnetic disks, optical disks, or tape. Such additional storage is illustrated in FIG. **11**B by the non-volatile storage area **1168**.

Data/information generated or captured by the mobile computing device **1100** and stored via the system **1102** may be stored locally on the mobile computing device **1100**, as described above, or the data may be stored on any number of storage media that may be accessed by the device via the radio interface layer **1172** or via a wired connection between the mobile computing device **1100** and a separate computing device associated with the mobile computing device **1100**, for example, a server computer in a distributed computing network, such as the Internet. As should be appreciated such data/information may be accessed via the mobile computing device **1100** via the radio interface layer **1172** or via a distributed computing network. Similarly, such data/information may be readily transferred between computing devices for storage and use according to well-known data/information transfer and storage means, including electronic mail and collaborative data/information sharing systems.

FIG. **12** illustrates one aspect of the architecture of a system for processing data received at a computing system from a remote source, such as a personal computer **1204**, tablet computing device **1206**, or mobile computing device **1208**, as described above. Content displayed at server device **1202** may be stored in different communication channels or other storage types. For example, various documents may be stored using a directory service **1222**, a web portal **1224**, a mailbox service **1226**, an instant messaging store **1228**, or a social networking site **1230**.

An Intelligent Email Subject Line Suggestion and Reformulation Module **1220** may be employed by a client that communicates with server device **1202**, and/or the Intelligent Email Subject Line Suggestion and Reformulation

Module **1221** may be employed by server device **1202**. The server device **1202** may provide data to and from a client computing device such as a personal computer **1204**, a tablet computing device **1206** and/or a mobile computing device **1208** (e.g., a smart phone) through a network **1215**. By way of example, the computer system described above may be embodied in a personal computer **1204**, a tablet computing device **1206** and/or a mobile computing device **1208** (e.g., a smart phone). Any of these embodiments of the computing devices may obtain content from the store **1216**, in addition to receiving graphical data useable to be either pre-processed at a graphic-originating system, or post-processed at a receiving computing system.

FIG. **12** illustrates an exemplary mobile computing device **1200** that may execute one or more aspects disclosed herein. In addition, the aspects and functionalities described herein may operate over distributed systems (e.g., cloud-based computing systems), where application functionality, memory, data storage and retrieval and various processing functions may be operated remotely from each other over a distributed computing network, such as the Internet or an intranet. User interfaces and information of various types may be displayed via on-board computing device displays or via remote display units associated with one or more computing devices. For example, user interfaces and information of various types may be displayed and interacted with on a wall surface onto which user interfaces and information of various types are projected. Interaction with the multitude of computing systems with which embodiments of the invention may be practiced include, keystroke entry, touch screen entry, voice or other audio entry, gesture entry where an associated computing device is equipped with detection (e.g., camera) functionality for capturing and interpreting user gestures for controlling the functionality of the computing device, and the like.

In accordance with at least one example, a system including a processor and memory is provided. The memory may store instructions that, when executed by the processor, cause the system to perform a set of operations. The set of operations may include receiving content corresponding to one or more portions of an email, determining, based on the one or more portions of the email, one or more email topics, determining, based on the one or more portions of the email, at least one intent of the email, formulating a subject line suggestion based on the one or more email topics and the at least one intent of the email, and causing the subject line suggestion to be output to a display device. At least one aspect of the above example includes where determining the one or more email topics includes comparing the content to a plurality of emails sent by a user to identify portions common to the received content and at least one email of the plurality of emails, removing the common portions from the received content, and generating a plurality of topic vectors based on the content remaining after removing the common portions. At least one aspect of the above example includes where the set of operations includes ranking each topic vector of the plurality of topic vectors based on a similarity to one or more topic vectors provided from a corpus of email, and formulating the subject line suggestion based on a topic vector and ranking. At least one aspect of the above example includes where the intent is at least one of a question, an action, a request for time, or a request for information. At least one aspect of the above example includes where the one or more portions of the email include the subject line. At least one aspect of the above example includes where the set of operations includes: selecting a subject line template based on the determined intent of the email, and populating one or more slots of the template utilizing the determined one or more email topics to generate the subject line suggestion. At least one aspect of the above example includes where the set of operations includes: identifying an email sent by a user that is similar to the received content corresponding to one or more portions of the email, extracting a subject line as a subject line suggestion from the email sent by the user, and updating one or more topics of the subject line suggestions utilizing one or more email topics. At least one aspect of the above example includes where the set of operations includes replacing an existing subject line of the email with the subject line suggestion.

In accordance with at least one example, a method is provided. The method may include receiving content corresponding to one or more portions of an email, determining, based on a first portion of content of the one or more portions of the email, one or more email topics, determining, based on a second portion of content of the one or more portions of the email, at least one intent of the email, formulating a subject line suggestion based on the one or more email topics and the at least one intent of the email, and causing the subject line suggestion to be output to a display device. At least one aspect of the above method may include where determining the one or more email topics includes comparing the first portion of content to a plurality of emails sent by a user to identify portions common to the received first portion of content and at least one email of the plurality of emails, removing the common portions from the received first portion of content; and generating a plurality of topic vectors based on the first portion of content remaining after removing the common portions. At least one aspect of the above method may include ranking each topic vector of the plurality of topic vectors based on a similarity to one or more topic vectors provided from a corpus of email, and formulating the subject line suggestion based on a topic vector and ranking. At least one aspect of the above method may include where the intent is at least one of a question, an action, a request for time, or a request for information. At least one aspect of the above method may include where the one or more portions of the email include the subject line. At least one aspect of the above method may include selecting a subject line template based on the determined intent of the email, and populating one or more slots of the template utilizing the determined one or more email topics to generate the subject line suggestion. At least one aspect of the above method may include identifying an email sent by a user that is similar to the second portion of content of the one or more portions of the email, extracting a subject line from the email sent by the user as a subject line suggestion from the email sent by the user, and updating one or more topics of the subject line suggestion utilizing the one or more email topics. At least one aspect of the above method may include receiving content corresponding to one or more portions of an email in response to receiving an indication that a user is composing an email. At least one aspect of the above method may include replacing an existing subject line of the email with the subject line suggestion.

In accordance with at least one example, a method is provided. The method may include receiving content corresponding to one or more portions of an email, identifying an email sent by the user that includes content similar to a first portion of content of the one or more portions of the email, extracting a subject line from the email sent by the user as a subject line suggestion, updating one or more topics of the subject line suggestion, and causing the subject line suggestion to be output to a display device. At least one aspect of

the above example may include determining, based on a first portion of content corresponding to one or more portions of the email, one or more email topics, and updating the subject line suggestion based on the determined one or more topics. At least one aspect of the above example includes replacing an existing subject line of the email with the subject line suggestion.

Aspects of the present disclosure, for example, are described above with reference to block diagrams and/or operational illustrations of methods, systems, and computer program products according to aspects of the disclosure. The functions/acts noted in the blocks may occur out of the order as shown in any flowchart. For example, two blocks shown in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

The description and illustration of one or more aspects provided in this application are not intended to limit or restrict the scope of the disclosure as claimed in any way. The aspects, examples, and details provided in this application are considered sufficient to convey possession and enable others to make and use the best mode of claimed disclosure. The claimed disclosure should not be construed as being limited to any aspect, example, or detail provided in this application. Regardless of whether shown and described in combination or separately, the various features (both structural and methodological) are intended to be selectively included or omitted to produce an embodiment with a particular set of features. Having been provided with the description and illustration of the present application, one skilled in the art may envision variations, modifications, and alternate aspects falling within the spirit of the broader aspects of the general inventive concept embodied in this application that do not depart from the broader scope of the claimed disclosure.

What is claimed is:

1. A system comprising:

a processor; and

memory storing instructions that, when executed by the processor, cause the system to perform a set of operations, the set of operations comprising:

receiving content corresponding to one or more portions of a current email being composed by a user;

parsing the received content corresponding to the one or more portions of the current email to identify one or more email topics;

evaluating the one or more email topics to determine an intent of the current email, wherein the determined intent is associated with one of a request, a question, a statement, or an action;

matching, to the determined intent, a one or more templates comprising a plurality of slots customized for formulating a subject line suggestion for the one of the request, the question, the statement, or the action, wherein contents of the plurality of slots are generated based on the identified one or more email topics;

formulating the subject line suggestion by populating at least one slot of the selected template with at least one email topic of the one or more email topics related to the determined intent;

wherein determining the one or more email topics further comprising:

comparing the received content to content of a plurality of previous emails to identify common content

identify other, non-common content in the previous emails containing common content and

generating a plurality of additional topic vectors based on common content providing a plurality of key terms to the plurality of topic vectors to determine an order of a plurality of combinations of the plurality of topic vectors and provide a highest ordered vector to the subject line suggestion; and

causing the subject line suggestion to be output to a display device.

2. The system according to claim **1**, wherein the set of operations includes:

ranking each topic vector of the plurality of topic vectors based on a similarity to one or more topic vectors provided from a corpus of previous emails; and

formulating the subject line suggestion based on populating the selected template with a topic vector having a higher ranking than other topic vectors of the plurality of topic vectors.

3. The system according to claim **1**, wherein the determined intent is a request for time or a request for information.

4. The system according to claim **1**, wherein the one or more portions of the current email include the subject line.

5. The system according to claim **1**, wherein the set of operations includes:

identifying content of a previous email that is similar to the received content corresponding to the one or more portions of the current email;

extracting a subject line from the previous email as an email topic; and

updating at least one slot of the selected template with the email topic including the extracted subject line.

6. The system according to claim **1**, wherein the set of operations includes replacing an existing subject line of the current email with the subject line suggestion.

7. The system of claim **1**, wherein formulating an updated subject line suggestion upon detection of changes to the one or more portions of the current email.

8. A method comprising:

receiving content corresponding to one or more portions of a current email being composed by a user;

parsing a first portion of the received content to identify one or more email topics of the current email;

determining, based on a second portion of the received content an intent of the current email, wherein the determined intent is associated with one of a request, a question, a statement, or an action;

matching, to the determined intent, a one or more templates comprising a plurality of slots customized for formulating a subject line suggestion for the one of the request, the question, the statement, or the action, wherein contents of the plurality of slots are generated based on the identified one or more email topics;

formulating the subject line suggestion by populating at least one slot of the selected template with at least one email topic of the one or more email topics that is related to the determined intent;

wherein determining the one or more email topics further comprising:

comparing the first portion of the received content to content of a plurality of previous emails to identify common content

identify other, non-common content in the plurality of previous emails containing common content;

generating a plurality of topic vectors based on common content of the first portion of the received content;

providing a plurality of key terms to the plurality of topic vectors to determine an order of a plurality of combinations of the plurality of topic vectors and provide a highest ordered vector to the subject line suggestion; and

causing the subject line suggestion to be output to a display device.

9. The method according to claim **8**, further comprising:

ranking each topic vector of the plurality of topic vectors based on a similarity to one or more topic vectors provided from a corpus of previous emails; and

formulating the subject line suggestion based on populating the selected template with a topic vector having a higher ranking than other topic vectors of the plurality of topic vectors.

10. The method according to claim **8**, wherein the determined intent is a request for time or a request for information.

11. The method according to claim **8**, wherein the one or more portions of the current email include the subject line.

12. The method according to claim **8**, further comprising:

identifying content of a previous email that is similar to the second portion of content of the current email;

extracting a subject line from the previous email as an extracted email topic of the previous email; and

updating at least one slot of the selected template with the extracted email topic of the previous email.

13. The method according to claim **8**, further comprising receiving the content corresponding to the one or more portions of the current email in response to receiving an indication that the user is composing the current email.

14. The method according to claim **8**, further comprising replacing an existing subject line of the current email with the subject line suggestion.

15. A method comprising:

receiving content corresponding to one or more portions of a current email being composed by a user;

parsing a first portion of the received content to identify one or more email topics of the current email;

determining, based on a second portion of the received content an intent of the current email, wherein the determined intent is associated with one of a request, a question, a statement, or an action;

matching, to the determined intent, a one or more templates comprising a plurality of slots customized for formulating a subject line suggestion for the one of the request, the question, the statement, or the action, wherein contents of the plurality of slots are generated based on the identified one or more email topics;

identifying a previous email sent by the user that includes similar content to the first portion of the received content of the current email;

extracting a subject line from the previous email sent by the user as an extracted email topic of the previous email;

updating the one or more email topics of the current email with the extracted email topic of the previous email;

formulating the subject line suggestion by populating at least one slot of the one or more slots of the selected template with the extracted email topic of the previous email;

wherein determining the one or more email topics further comprising:

comparing the first portion of the received content to content of a plurality of previous emails to identify common content;

identify other, non-common content in the plurality of previous emails containing common content

generating a plurality of topic vectors based on common content of the first portion of the received content:

providing a plurality of key terms to the plurality of topic vectors to determine an order of a plurality of combinations of the plurality of topic vectors and provide a highest ordered vector to the subject line suggestion; and

causing the subject line suggestion to be output to a display device.

16. The method of claim **15**, further comprising replacing an existing subject line of the current email with the subject line suggestion.

17. The method of claim **15**, wherein the determined intent is a request for time or a request for information.

18. The method of claim **15**, further comprising:

ranking each topic vector of the plurality of topic vectors based on a similarity to one or more topic vectors provided from a corpus of previous emails; and

formulating the subject line suggestion based on populating the selected template with a topic vector having a higher ranking than other topic vectors of the plurality of topic vectors.

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